powerOne® Graph

Version 4.2

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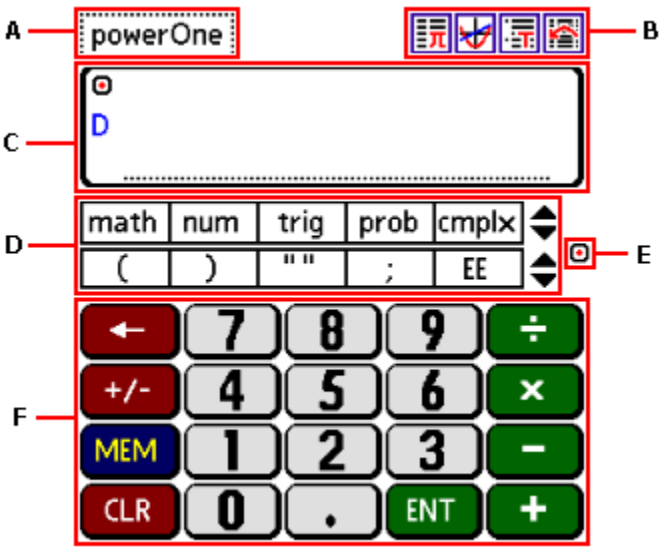
1 Using the Calculator

1.1 Interface Overview

This section discusses the interface for powerOne Graph.

1.1.1 Display



A. powerOne Button (select this button for a list of options):

- Copy: copy contents of view window to the system clipboard. See Memory & Storage : System Clipboard for more information.
- Paste: paste the system clipboard to the view window. See Memory & Storage : System Clipboard for more information.
- Calculation Log: log of calculations similar to a tape. The Palm OS version records the last 20 calculations (or 10 equation/answer combinations for algebraic input mode). See Memory & Storage : Calculation Log for more information.
- Preferences: calculator preferences. See Using the Calculator : Preferences for more information.
- Skins: change the user interface of the calculator (colors and layout). See Using the Calculator : Skins for more information.
- My Data: location to see all calculator data including constants, macros, and variables. Can also create new data, whether constants, macros, variables, tables or matrices.
- My Graphs: location to see all graph equations, create new equations, set window coordinates and graph.
- My Templates: location to see all templates, whether created or pre-installed.
- About powerOne: information about the product.

B. Navigation Buttons (from left to right):

- Data Button: displays My Data. See the Memory & Storage : My Data section for more information.
- Graph Button: displays My Graphs. See the Graphing : My Graphs section for more information.
- Template Button: displays list of available templates similar to My Templates. See the Templates : Template List section for more information.
- Last Template Button: select to go to the previously used template (only visible when a template has been visited).

C. View Window: displays calculation and status information. See the Using the Calculator : Input Modes section for more information.

D. Function Bar: consists of 8 lines, each with 5 buttons. Selecting one performs the associated function. Scroll up and down to see other functions. Buttons can access a function, can display a list of functions or can be associated with a template. These buttons are programmable and can be set in the Preferences screen. See the Using the Calculator : Preferences section for more information on setting the function bar. There are also programmable buttons available in some skins (not pictured). These are not available in the default powerOne Graph skin. Programmable buttons are similar to the function bar but have a set number of locations and can change in shape, size and direction. These are also discussed in the Using the Calculator : Preferences section.

E. Function Button: select this button to display a list of function categories. Select a function category to access a mathematical function.

F. Keypad: calculator keypad consists of numbers, basic arithmetic, backspace, clear, positive/negative button and

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memory button. Selecting memory shows recall, store and clear. Select store and a memory location to store the view window's contents to that memory location. Select recall and a memory location to recall that memory location's contents to the view window. Select clear to clear the memory locations.

- 0-9: numbers 0 through 9.
- decimal separator: separate the whole and decimal portions of the number. Either entered as a period or comma depending on the system setting for number display format.
- +, –, x, ÷ (plus, minus, times, divide): basic mathematics functions.
- ENT or equals: enter key to evaluate the equation (algebraic input mode), push a value on the stack (RPN input mode), or complete a calculation (order of operations and chain input modes).
- CE/C: clears the currently entered value on the first selection and all values (entire calculation or history depending on the input mode) on the second selection.
- MEM: select to access store, recall or clear memory location functionality. See the Memory & Storage : Memory Locations section for more information.
- +/–: select to change the sign or insert a negative sign depending on the input mode.
- ← (backspace arrow): deletes the highlighted area, space before the input cursor, or last entered value depending on the input mode.

1.1.2 Skins

Skins add a personalized look to the main and pop-up calculators. Some skins offer a different button layout with the advanced mathematics functions in drop down lists or giving access to programmable buttons for example. Other skins offer different color schemes.

To download free skins, go to this product's web page at www.infinitysw.com/graph.

Installing Skins

After downloading a skin from Infinity Softworks' web site and synchronizing it to your device's main memory, run the application. The skin will be imported automatically. To install a skin from an expansion card, select "Skins" from the "powerOne" button and choose "Import" to find it.

Changing Skins

To change skins, select "Skins" from the "powerOne" button. Choose the desired skin and then select "OK". The calculator display will change automatically. "<Default>" is the original display that came with your product.

Deleting Skins

To delete a skin, select "Skins" from the "powerOne" button. Choose the desired skin and select "Delete". The default skin cannot be deleted.

Problems with Skins

If there is a device problem when working in a skin, it is possible to return to the default skin when launching the software. To do so, hold the down scroll or 5-way navigation button when starting the software.

1.1.3 Menus

Choosing the menu button to the lower, left-hand corner of the Graffiti input area accesses the menus. Standard PalmOS edit choices, Graffiti help, Preferences, and application information can be accessed from here.

The Edit menu:

- **Undo:** shortcut U, undo the last cut/copy/paste or entry in the field. Algebraic and RPN input modes only.
- **Cut:** shortcut X, cut the selected text to the clipboard.
- **Copy:** shortcut C, copy the selected text to the clipboard.
- **Paste:** shortcut P, paste the selected text from the clipboard to the entry line.
- **Select All:** shortcut S, selects all text in the entry line. Algebraic and RPN input modes only.
- **Keyboard:** shortcut K, displays the Palm OS keyboard for data entry. Algebraic and RPN input modes only.
- **Graffiti Help:** shortcut G, help with Graffiti keystrokes.

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The Options menu:

- **Preferences:** shortcut R, displays the calculator preferences.
- **Clear Memory:** shortcut Y, clear the calculator's 10 memory locations.
- **About powerOne:** displays company information.

Copy, paste, error and keystroke help, preferences and the about screen can all be reached from the powerOne button as well.

1.1.4 Pop-up Calculator

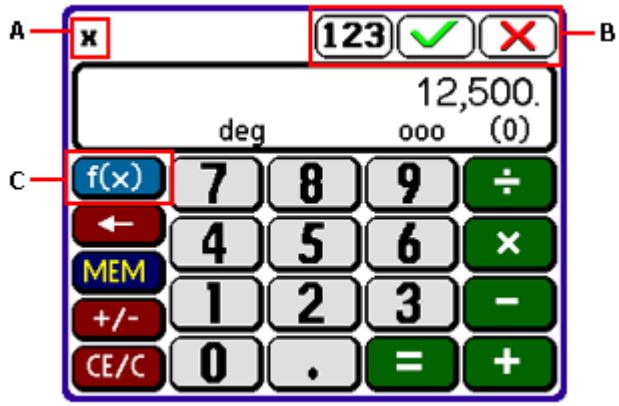
The pop-up calculator is used throughout the application when values are required, such as in a table or template. The pop-up calculator functions similarly to the main calculator and offers the same input modes. Functionality specific to the pop-up calculator is detailed here. See the Interface Overview : Display section for information on shared main and pop-up calculator functionality and the Input Modes section for information specific to each available input mode.

A. Variable Name: displays the name of the selected variable.

B. Buttons (from left to right)**:**

- Input Mode Button: displays a list of available input modes.
- Save Button: select the "✓" button to store the value in the view window and return to the previous view.
- Cancel Button: select the "x" button to return without storing.

C. Function Button: displays a list of functions available in the pop-up calculator. This list's functionality depends on the currently selected input mode. See the Using the Calculator : Input Modes for more information.



In general, entries made in the pop-up calculator are separate from those in the main calculator. To move data between them, store the information in a memory location (MEM : Store). See the Using the Calculator : Memory & Storage section for more information.

1.2 Input Modes

An input mode is the method by which calculations are performed in the main calculator. The different modes reflect the variety of calculation methods performed by currently available hardware calculators.

The currently selected skin dictates the available input modes. See Using the Calculator : Interface Overview : Skins for more information.

The input mode is set in the preferences. See Using the Calculator : Interface Overview for more information on accessing the preferences.

1.2.1 Algebraic Input Mode

Algebraic is the most common input mode used with scientific calculators. In algebraic mode, the entire equation is entered than the [ENT] button is selected to evaluate the equation. This mode follows common order of operation rules for function precedence.

The following chart outlines function precedence. Functions with a lower order are executed before functions with a higher order:

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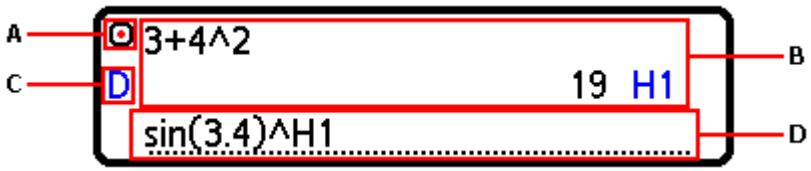
Order	#Function
1	Negative (-x)
2	Powers and roots
3	Multiplication, division, and percentages
4	Addition and subtraction
5	Relationship operations (>, <=)
6	Logic or Boolean operations (or, and)

For example, 27 + 3 x 8.5 is evaluated as (3 x 8.5) + 27:

Key	Display	Comments
CLR		
27	27	
+	27+	
3	27+3	
x	27+3*	
8.5	27+3*8.5	
ENT	52.5	Enter evaluates the entire equation at once

1.2.1.1 Display



A. History List: shows the past 4 equation/answer combinations. Select the button to see the list. It is organized the same as in B below.

B. Last Equation/Answer: the top line shows the last equation entered, the lower line shows the last result. To recall the last equation entered to the entry line, select it. To recall the last result as the number of decimal places displayed on the screen, select the last answer's value (19 in the picture). Selecting the location designation (H1 in this picture) does one of three things. If the designation starts with H, selecting it recalls the full precision to the entry line for use in the next calculation. If the designation starts with M, selecting it displays the matrix editor. If the designation starts with T, selecting it displays the table editor.

C. Base-Fraction Mode: select this button to change number base or to display results as fractions. For instance, after changing the mode to hexadecimal, all entries and calculations are assumed to be hexadecimal unless designated as something else. See the Using the Calculator : Types of Data section for detailed information on each mode:

- Fraction: results are displayed as fractions (e.g, 3/4).
- Mix Fraction: results are displayed as mixed fractions (e.g, 2+4/5).
- Binary: results are displayed as binary numbers (e.g, 11001_b) and values entered into the entry line are treated as binary numbers.

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- Octal: results are displayed as octal numbers (e.g, 845_o) and values entered into the entry line are treated as octal numbers.
- Decimal: decimal mode is the default mode for entering values, complex numbers, etc (e.g, 8.35, 90_d).
- Hexadecimal: results are displayed as hexadecimal numbers (e.g, 8F_h, 0AC_h) and values entered into the entry line are treated as hexadecimal numbers. Hexadecimal numbers that begin with a letter must start with 0 (e.g, 0AC_h instead of AC_h).

D. Entry Line: enter the calculation on the line. If the calculation is longer than a single line, a scroll bar will appear (not pictured here).

1.2.1.2 Implicit Multiplication

In certain cases, implicit multiplication is available. Implicit multiplication is where 2 times x is entered as 2x. In algebraic input mode, multiplication is assumed if the math symbol is missing.

The following examples will support implicit multiplication:

- 2x : assumed to be 2 * x.
- 2 x : (note: the space between 2 and x), assumed to be 2 * x.
- a b : (note: the space between a and b), assumed to be a * b.
- 3(x+2) : assumed to be 3 * (x + 2).
- {1; 2; 3}x^2 : assumed to be list {1; 2; 3} * x^2.
- 4sin(25) : assumes 4 * sin(25).

The following examples will not support implicit multiplication

- ab : this is not a * b, but instead the variable 'ab'. (Enter a multiplication symbol or space between a and b to handle correctly.)
- a2 : this is not a * 2, but instead the variable 'a2'. (Enter a multiplication symbol or space between a and b to handle correctly.)
- a(2+3) : this is not a * (2+3), but instead the function call a(5). (A number before a parentheses is allowed but a variable before a parentheses is not. Also, a space between a and (2+3) would also be considered a function call.)

1.2.1.3 Preferences

The following preferences are available in algebraic input mode. See the Using the Calculator : Preferences section for more information:

- **Decimal Setting:** float or 0 through 11.
- **Display Mode:** normal, scientific or engineering notation.
- **Complex Type:** auto-detect, always rectangular, always polar.
- **Complex Frmt:** display as (a;b) | (r;@t) format or (a+b*i) | (r*e^t*i) format.
- **Unary Op:** -2^2 equals -4 (like TI) or 4 (like HP).
- **Trig Mode:** degrees or radians.

1.2.1.4 Functions

Different input modes offer different functions. This lists the available functions for algebraic input mode. To learn how to see a complete list of functions organized by category, See the Using the Calculator : Interface Overview section. To learn more about an individual function, see the Functions section.

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math		
1/x	log	$\sqrt[x]{y}$
%x	10^x	mod
y^x	x^2	gcd
ln	$\sqrt{x}$	lcm
e^x	$\sqrt[3]{x}$	solve

number			
;	iPart	rnd	toFloat
(	fPart	degs	→frac
)	floor	dms	→mFrac
EE	ceil	toBool	
abs	sign	toInt	

trig		
sin	sinh	sec
cos	cosh	csc
tan	tanh	cot
asin	asinh	degrees
acos	acosh	radians
atan	atanh	

prob	
nPr	randT
nCr	randTInt
x!	RandNorm *
rand	RandBin *
randInt	

stats		
{ } (tbl)	median	variance
countX	min	varianceP
sumX	max	sigma
sumX2	stdDev	seq
mean	stdDevP	prod

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distr		
nDist	NormalCDF *	fCDF *
invNorm	NormalPDF *	fPDF *
BinomCDF *	GeometCDF *	chiCDF *
BinomPDF *	GeometPDF *	chiPDF *
PoissonCDF *	tCDF *	
PoissonPDF *	tPDF *	

* These functions are only available if the statistics library is installed.

cmplx	
i	real
@	theta
conj	toRect
imag	toPolar

calc	
'x'	fnInt
" "	fMax
nDeriv	fMin
nDeriv2	

matrix					
[ ] (mtrx)	rref	rNorm	min	*row+	dim
{ } (tbl)	trans	cNorm	max	fill	getItem
x^{-1}	identity	cond	rowSwap	augment	getRow
det	cumSum	cross	row+	append	getCol
ref	norm	dot	row*	redim	

cnst **		
New Constant...	c	Me
Edit...	ec	Mn
e	g	Mp
i	G	NA
pi	k	R

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vars **
New Variable...
New Table...
New Matrix...
Edit...
=

macro **
New Macro...
Edit...
:=

** These lists change when new constants, variables and macros are created, inserting new items in alphabetical order at the top of the list. See the Memory & Storage : My Data section for more information on creating new constants, variables and macros.

bool		
==	<=	||
<>	>=	##
<	!x	if
>	&&	choose

dev			
~x	_b	b	A
&	_o	o	B
|	_d	d	C
#	_h	h	D
<<			E
>>			F

date	
adjDate	getDate
adjTime	getTime
makeDate	HRS
weekDay	HMS
dDays	today

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finance ***					
IntEff	TvmFV	BondY	DepDBBV	DepSOYDBV	CfoNUS
IntNom	TvmI	BondA	DepDBDV	DepSOYDDV	CfoPbk
SPFV	TvmN	DepSLDA	DepDBSLDA	CfoNPV	CfoProf
SPPV	TvmPmt	DepSLBV	DepDBSLBV	CfoIRR	CfoTot
USFV	TvmPV	DepSLDV	DepDBSLDV	CfoNFV	CfoCount
USPV	BondP	DepDBDA	DepSOYDDA	CfoMIRR	

*** These functions are only available if the finance library is installed.

1.2.2 RPN Input Mode

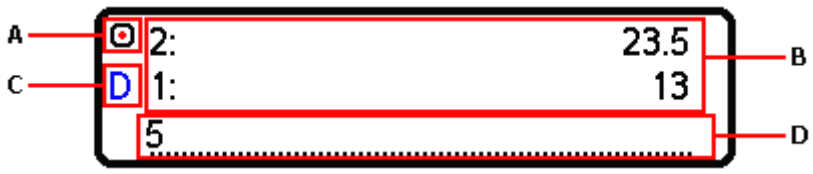
RPN is the input mode familiar to many HP calculator users. RPN is a post-fix notation where numbers are pushed on a stack by pressing [ENT]. This mode does not follow order of operations – instead it uses the model of the last value pushed on the stack is the first one off.

To calculate (27 + 3) x 8.5:

Key	Display	Comments
CE/C		Clears the stack.
27	27	
ENT	0: 27	
3	1: 27 3	
+	0: 30	
8.5	1: 30 8.5	
x	255	

Entering 8.5, 3 and 27 then adding and finally multiplying will derive the same answer.

1.2.2.1 Display



A. Full Stack: shows the complete stack. The number to the left is the stack position while the item to the right is the data pushed onto the stack. Stack functions are available by selecting a stack item.

B. Partial Stack: shows the last 2 to 3 stack entries. The number to the left is the stack position while the item to the right is the data pushed onto the stack. For stack functions, select a stack item.

C. Base-Fraction Mode: select this button to change the display to support a specific mode. For instance after changing the mode to hexadecimal, all entries and calculations are assumed to be in this mode unless designated as something

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else. See the Using the Calculator : Types of Data section for detailed information on each mode:

- Fraction: results are displayed as fractions (e.g, 3/4).
- Mix Fraction: results are displayed as mixed fractions (e.g, 2+4/5).
- Binary: results are displayed as binary numbers (e.g, 11001_b) and values entered into the entry line are treated as binary numbers.
- Octal: results are displayed as octal numbers (e.g, 845_o) and values entered into the entry line are treated as octal numbers.
- Decimal: decimal mode is the default mode for entering values, complex numbers, etc (e.g, 8.35, 90_d).
- Hexadecimal: results are displayed as hexadecimal numbers (e.g, 8F_h, 0AC_h) and values entered into the entry line are treated as hexadecimal numbers. Hexadecimal numbers that begin with a letter must start with 0 (e.g, 0AC_h instead of AC_h).

D. Entry Line: enter values on the line. If the value is longer than a single line, a scroll bar will appear (not pictured here).

1.2.2.2 Stack

There are special functions for manipulating the stack. These functions can be reached by tapping an item pushed onto the stack or choosing the category Stack from the function list and then selecting the desired function. If an item is selected on the stack, the function selected will adjust based on that item. If a stack function is selected from the function list the first item on the stack will be the focal point.

- **Drop:** deletes the item.
- **Duplicate** (dup)**:** copies the item into register 0 (view window/entry line), pushing all others up.
- **Move:** removes the item from its location in the stack and places it in register 0 (view window/entry line).
- **Rotate** (rot)**:** moves the stack in a clockwise direction.
- **Rotate Rvrs** (rotr)**:** moves the stack in a reverse or counter-clockwise direction.
- **Swap:** swaps the item with the contents of register 0 (view window/entry line).

1.2.2.3 Preferences

The following preferences are available in RPN input mode. See the Using the Calculator : Preferences section for more information:

- **Stack Size:** 4, 11 or max registers. Includes register 0 (view window/entry line). The maximum number of registers available is 64.
- **Enter Mode:** HP 48 where enter does not push a duplicate of the view window/entry line onto the stack or All Other HP calculators that do push a duplicate of the view window/entry line onto the stack.
- **Decimal Setting:** float or 0 through 11.
- **Display Mode:** normal, scientific or engineering notation.
- **Complex Type:** auto-detect, always rectangular, always polar.
- **Complex Frmt:** display as (a;b) | (r;@t) format or (a+b*i) | (r*e^t*i) format.
- **Trig Mode:** degrees or radians.

1.2.2.4 Functions

Different input modes offer different functions. This lists the available functions for RPN input mode. To learn how to see a complete list of functions organized by category, See the Using the Calculator : Interface Overview section. To learn more about an individual function, see the Functions section.

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math		
1/x	log	$\sqrt[x]{y}$
%x	10^x	mod
y^x	x^2	gcd
ln	$\sqrt{x}$	lcm
e^x	$\sqrt[3]{x}$	

number			
last	EE	ceil	toBool
show	abs	sign	toInt
;	iPart	rnd	toFloat
(	fPart	degs	→frac
)	floor	dms	→mFrac

trig		
sin	sinh	sec
cos	cosh	csc
tan	tanh	cot
asin	asinh	degrees
acos	acosh	radians
atan	atanh	

prob	
nPr	randT
nCr	randTInt
x!	RandNorm *
rand	RandBin *
randInt	

stack	
drop	rotr
dup	swap
move	stack
rot	

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stats		
{ } (tbl)	median	variance
countX	min	varianceP
sumX	max	sigma
sumX2	stdDev	seq
mean	stdDevP	prod

distr		
nDist	NormalCDF *	fCDF *
invNorm	NormalPDF *	fPDF *
BinomCDF *	GeometCDF *	chiCDF *
BinomPDF *	GeometPDF *	chiPDF *
PoissonCDF *	tCDF *	
PoissonPDF *	tPDF *	

* These functions are only available if the statistics library is installed.

cmplx	
i	real
@	theta
conj	toRect
imag	toPolar

calc	
'x'	fnInt
" "	fMax
nDeriv	fMin
nDeriv2	

matrix					
[ ] (mtrx)	rref	rNorm	min	*row+	dim
{ } (tbl)	trans	cNorm	max	fill	getItem
x^{-1}	identity	cond	rowSwap	augment	getRow
det	cumSum	cross	row+	append	getCol
ref	norm	dot	row*	redim	

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cnst **		
New Constant...	c	Me
Edit...	ec	Mn
e	g	Mp
i	G	NA
pi	k	R

vars **
New Variable...
New Table...
New Matrix...
Edit...
=

** These lists change when new constants and variables are created, inserting new items in alphabetical order at the top of the list. See the Memory & Storage : My Data section for more information on creating new constants and variables. Macros defined as constants will not show in the Constants list.

bool		
==	<=	||
<>	>=	##
<	!x	
>	&&	

dev			
~x	_b	b	A
&	_o	o	B
|	_d	d	C
#	_h	h	D
<<			E
>>			F

date	
adjDate	getDate
adjTime	getTime
makeDate	HRS
weekDay	HMS
dDays	today

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finance ***					
IntEff	TvmFV	BondY	DepDBBV	DepSOYDBV	CfoNUS
IntNom	TvmI	BondA	DepDBDV	DepSOYDDV	CfoPbk
SPFV	TvmN	DepSLDA	DepDBSLDA	CfoNPV	CfoProf
SPPV	TvmPmt	DepSLBV	DepDBSLBV	CfoIRR	CfoTot
USFV	TvmPV	DepSLDV	DepDBSLDV	CfoNFV	CfoCount
USPV	BondP	DepDBDA	DepSOYDDA	CfoMIRR	

*** These functions are only available if the finance library is installed.

1.2.3 Order of Operations Input Mode

Order of operations is a standard calculator mode where only the currently entered number appears in the view window. This mode follows standard entry where numbers are entered in order of appearance and a final calculation is performed when [=] is selected. As the name indicates, it follows standard order of operations rules.

The following chart outlines precedence:

Order	#Function
1	Negative (-x)
2	Powers and roots
3	Multiplication, division, and percentages
4	Addition and subtraction
5	Relationship operations (>, <=)
6	Logic or Boolean operations (or, and)

To calculate 27 + 3 x 8.5:

Key	Display	Comments
CE/C		Clears the current calculation.
27	27	
+	27	
3	3	
x	3	
8.5	8.5	
=	52.5	

On Palm OS handhelds, Graffiti® entry is supported for both the main and pop-up calculators. To learn how to draw each character, see your handheld user manual.

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Character	Function	Character	Function
0	Zero	<back> <space>	Backspace
1	One	c	C/CE
2	Two	+	Add
3	Three	–	Subtract
4	Four	x *	Multiply
5	Five	/	Divide
6	Six	=	Equals/Enter
7	Seven	(	Lt Paren
8	Eight	)	Rt Paren
9	Nine	s	Store
. ,	Decimal Pt	r	Recall
n	Sign	<return>	Save
e	Exponent		

Note that the Graffiti shift indicator is in the view window both on the main and pop-up calculators.

1.2.3.1 Display

A. View Window: number display area.

B. Status Indicators:

- Shift Indicator: Standard Palm OS Graffiti shift indicator.
- Clear: Clear serves two functions in this mode. Selecting it once displays the clear indicator and clears only the number currently being entered. Selecting it the second time clears the entire calculation. If the status indicator "clear" appears, the currently entered number has been cleared.
- Deg/Rad: Whether calculator is in degrees or radians mode.
- OOO: Currently in order of operations input mode.
- (0): parentheses indicator. The number in the middle shows the number of left parentheses that are still open (i.e., do not have a closing right parenthesis).

1.2.3.2 Preferences

The following preferences are available in order of operations input mode. See the Using the Calculator : Preferences section for more information:

- **Decimal Setting:** float or 0 through 11.
- **Display Mode:** normal, scientific or engineering notation.

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- **Trig Mode:** degrees or radians.

1.2.3.3 Functions

Different input modes offer different functions. This lists the available functions for order of operations input mode. To learn how to see a complete list of functions organized by category, see the Using the Calculator : Interface Overview section. To learn more about an individual function, see the Functions section.

math		
1/x	log	$\sqrt[x]{y}$
%x	10^x	mod
y^x	x^2	gcd
ln	√x	lcm
e^x	$\sqrt[3]{x}$	

number		
last	abs	sign
show	iPart	rnd
(	fPart	degs
)	floor	dms
EE	ceil	

trig		
sin	sinh	sec
cos	cosh	csc
tan	tanh	cot
asin	asinh	degrees
acos	acosh	radians
atan	atanh	

prob
nPr
nCr
x!
rand

history *

* History is a special function that displays the last 10 recorded answers. Each time the equals [=] button is selected, a new history item is added to the list. To recall a history item to the view window, select it from the list (or choose function Last for the last value added to the history list).

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cnst **		
New Constant...	ec	Mn
Edit...	g	Mp
e	G	NA
pi	k	R
c	Me	

vars **
New Variable...
Edit...

** These lists change when new constants and variables are created, inserting new items in alphabetical order at the top of the list. See the Memory & Storage : My Data section for more information on creating new constants and variables. Macros defined as constants will not show in the Constants list. Matrices and tables will not show in the Variables list.

1.2.4 Chain Input Mode

Chain input mode is the most common mode found in financial calculators. It is a mode where only the currently entered number appears in the view window. This mode follows standard entry where numbers are entered in order of appearance and a final calculation is performed when [=] is selected. Order of operations is ignored, opting instead to evaluate as numbers are entered and operands are selected.

To calculate 27 + 3 x 8.5:

Key	Display	Comments
CE/C		Clears the current calculation.
27	27	
+	27	
3	3	
x	30	
8.5	8.5	
=	255	

On Palm OS handhelds, Graffiti® entry is supported for both the main and pop-up calculators. To learn how to draw each character, see your handheld user manual.

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Character	Function	Character	Function
0	Zero	<back> <space>	Backspace
1	One	c	C/CE
2	Two	+	Add
3	Three	–	Subtract
4	Four	x *	Multiply
5	Five	/	Divide
6	Six	=	Equals/Enter
7	Seven	(	Lt Paren
8	Eight	)	Rt Paren
9	Nine	s	Store
. ,	Decimal Pt	r	Recall
n	Sign	<return>	Save
e	Exponent		

Note that the Graffiti shift indicator is in the view window both on the main and pop-up calculators.

1.2.4.1 Display

A. View Window: number display area.

B. Status Indicators:

- Shift Indicator: Standard Palm OS Graffiti shift indicator.
- Clear: Clear serves two functions in this mode. Selecting it once displays the clear indicator and clears only the number currently being entered. Selecting it the second time clears the entire calculation. If the status indicator "clear" appears, the currently entered number has been cleared.
- Deg/Rad: Whether calculator is in degrees or radians mode.
- Chain: Currently in chain input mode.
- (0): parentheses indicator. The number in the middle shows the number of left parentheses that are still open (i.e., do not have a closing right parenthesis).

1.2.4.2 Preferences

The following preferences are available in chain input mode. See the Using the Calculator : Preferences section for more information:

- **Decimal Setting:** float or 0 through 11.
- **Display Mode:** normal, scientific or engineering notation.

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- **Trig Mode:** degrees or radians.

1.2.4.3 Functions

Different input modes offer different functions. This lists the available functions for chain input mode. To learn how to see a complete list of functions organized by category, see the Using the Calculator : Interface Overview section. To learn more about an individual function, see the Functions section.

math		
1/x	log	$\sqrt[x]{y}$
%x	10^x	mod
y^x	x^2	gcd
ln	√x	lcm
e^x	$\sqrt[3]{x}$	

number		
last	abs	sign
show	iPart	rnd
(	fPart	degs
)	floor	dms
EE	ceil	

trig		
sin	sinh	sec
cos	cosh	csc
tan	tanh	cot
asin	asinh	degrees
acos	acosh	radians
atan	atanh	

prob
nPr
nCr
x!
rand

history *

* History is a special function that displays the last 10 recorded answers. Each time the equals [=] button is selected, a new history item is added to the list. To recall a history item to the view window, select it from the list (or choose function Last for the last value added to the history list).

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cnst **		
New Constant...	ec	Mn
Edit...	g	Mp
e	G	NA
pi	k	R
c	Me	

vars **
New Variable...
Edit...

** These lists change when new constants and variables are created, inserting new items in alphabetical order at the top of the list. See the Memory & Storage : My Data section for more information on creating new constants and variables. Macros defined as constants will not show in the Constants list. Matrices and tables will not show in the Variables list.

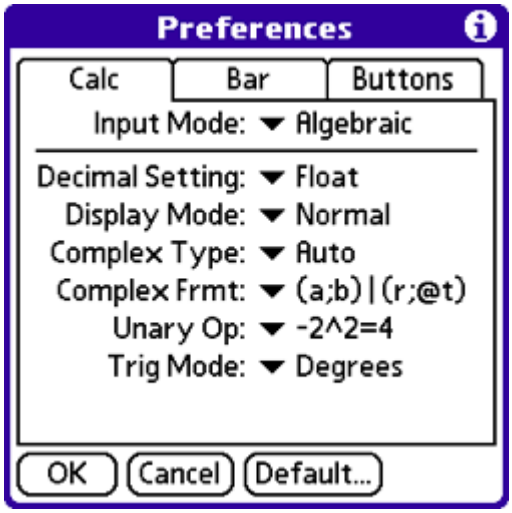
1.3 Preferences

Preferences are used to store information about how the calculator functions, set the function bar and set the programmable buttons. The "Bar" and/or "Button" tabs only appear if the selected skin offers these functions.

Access the preferences by selecting "powerOne" then "Preferences".

1.3.1 Calc Tab

Display changes depending on the input mode selected. Options are:



Input Mode

[algebraic, RPN, order of operations, chain modes] the currently selected input mode.

All input modes may not be available with all skins. For more on each input mode, see the Using the Calculator : Input Modes section. To learn more about skins, see the Using the Calculator : Interface Overview : Skins section.

Stack Size

[RPN] size of the stack.

The stack can either be 4 items tall (3 locations and the entry line/view window), 11 items (10 locations and the entry line/view window) or max items high. Max is restricted to 64 items.

Enter Mode

[RPN] how the stack is handled when [ENT] is selected in RPN input mode.

HP48 calculators treat "Enter" differently than all other HP RPN calculators. On the HP48, [3] [ENT] [+] results in an error because not enough items are pushed onto the stack. On other HP calculators, the same sequence results in 6 (3 + 3), since it pushes 3 into the first register without removing it from the entry line/view window. Choose HP 48 to match the HP48 or All Others for the alternative sequence. For reference, previous versions of Infinity Softworks' financial

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calculators only offered a mode equivalent to the HP48.

Decimal Setting

[algebraic, RPN, order of operations, chain modes] number of decimal places to display.

Float shows all available decimal places. 0 through 11 shows that many decimal places. With very large numbers, fewer decimal places may be displayed because of the total number of places available to show in the view window. In addition, the Show function displays all available decimal places until the next entry is made. This can be used to quickly see all available decimal places when the decimal setting is not set to float.

Display Mode

[algebraic, RPN, order of operations, chain modes] display numbers in normal, scientific or engineering notation.

Normal mode displays numbers as would normally be written on paper or, if the number is very large or very small, in scientific notation. Scientific mode displays numbers as two parts -- the significant digits with one digit before the decimal and the exponent (e.g, 3.45e67). The number of places displayed after the decimal point is determined by the decimal setting. Engineering mode also displays numbers in two parts -- the significant digits and the exponent that is always a multiple of 3 (e.g, 34.567e12). The number of significant digits is 1 plus the decimal setting.

Complex Type

[algebraic, RPN] sets the type of complex number to be displayed.

Choose between auto, rectangular or polar. In auto mode, the calculator will display a complex number answer in rectangular or polar format depending on the format preferred by the last operation performed. If set to rectangular, answers will always return in rectangular format [either (a;b) or (a+b*i) format]. If set to polar, answers will always return in polar format [either (r;@t) or (r*e^t*i) format]. See the Types of Data : Complex Numbers section for more information on complex numbers.

Complex Frmt

[algebraic, RPN] sets the format in which a complex number is displayed.

Complex numbers can be displayed and entered in a format standard to Infinity Softworks [(a;b) or (r;@t for rectangular and polar, respectively] or can be displayed in a standard mathematical format [(a+b*i) or (r*e^t*i) for rectangular and polar, respectively]. See the Types of Data : Complex Numbers section for more information on complex numbers.

Unary Op

[algebraic] determines whether the negative sign has higher or lower precedence than power operations.

Different calculators offer different precedence. TI calculators use the convention $-2^{\angle} = -4$ while HP calculators follow the rule $-2^{\angle} = 4$.

Trig Mode

[algebraic, RPN, order of operations, chain modes] calculates trigonometric functions as either degrees or radians.

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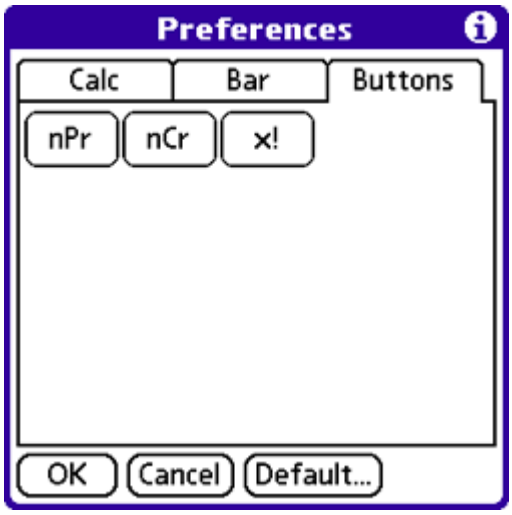
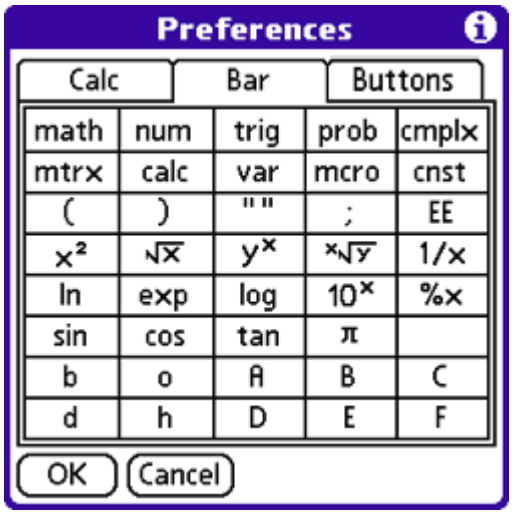
1.3.2 Button Tab



The button tab appears when the current skin has programmable buttons. This option may not appear in the default skin if that skin does not offer programmable buttons.

To change the content of any button, select it and choose a new item from the list. To choose a function, select its category and then the function itself. At the bottom of the list are Category, Calc Log, Template and Empty. Select Category to set the button to a Function Category. Select Calc Log to set a button to the Calculation Log. Select Template to set an individual template to a button (requires a shortened name). To leave the button blank, select Empty.

1.3.3 Bar Tab



The bar tab appears when the current skin has a function bar. This option may not appear in the default skin if that skin does not offer a function bar.

To change the content of any location on the bar, select it and choose a new item from the list. To choose a function, select its category and then the function itself. At the bottom of the list are Category, Calc Log, Template and Empty. Select Category to set the location to a Function Category. Select Calc Log to set a location to the Calculation Log. Select Template to set an individual template to a location (requires a shortened name). To leave the location blank, select Empty.

The main calculator shows 1 or 2 lines of the 8 available for the function bar. To see other function bar lines, use the scroll arrows next to that bar to move up or down.

1.4 Memory & Storage

Storing data is important when performing advanced calculations. Multiple methods are available for storing and moving data within this product and with other, external sources. Most are outlined in this section. Additional information can be found in the Graphing : Sharing Graphs section and the Templates : Using the Templates section.

1.4.1 My Data

My Data displays created data, whether functions, variables or constants. Stored data can be variables, macros, constants, tables or matrices. See the Using the Calculator : Interface Overview section for more information on accessing My Data.

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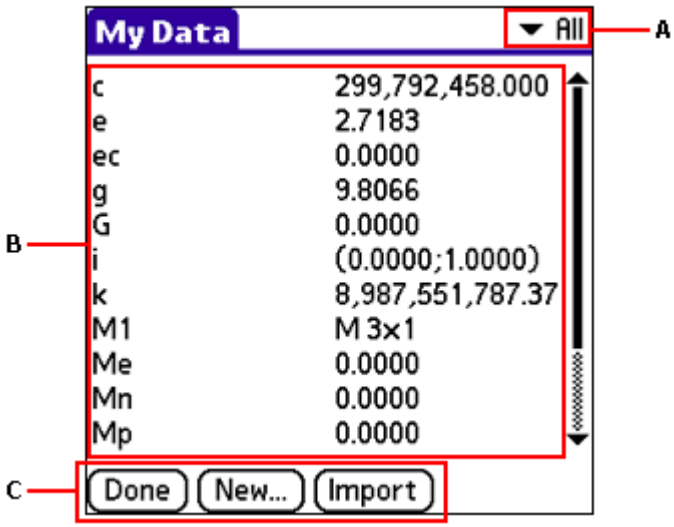
A. Categories: select the category name to choose a different display. "All" shows all data at the same time, whether variables, functions or constants. Other categories show just their corresponding data type.

B. Data Listing: each data line shows the variable's name to the left and the value of that variable to the right. For tables and matrices, the letter indicator (T or M respectively) is followed by the size. Select a data line to show options:

- Use: select to recall the value to the main calculator. In algebraic input modes, this recalls the name of the data item. In RPN input mode, this pushes the data item onto the stack. In order of operations and chain input modes, it returns the value for constants and variables only (tables, matrices and functions are ignored). Data items can also be found by selecting the cnst, vars or func category in the function list.



- Edit: shows the data editor. See the appropriate Types of Data section for more information on creating and editing data.
- Details: available for matrices and tables only, displays name and row/column information.
- Export/Beam: select to show export and beam options for the data item. See the Sharing Data section for more information.
- Delete: select to delete the data item.
- Duplicate: select to make a copy of the data item.
- Notes: display notes pertaining to the selected data item.

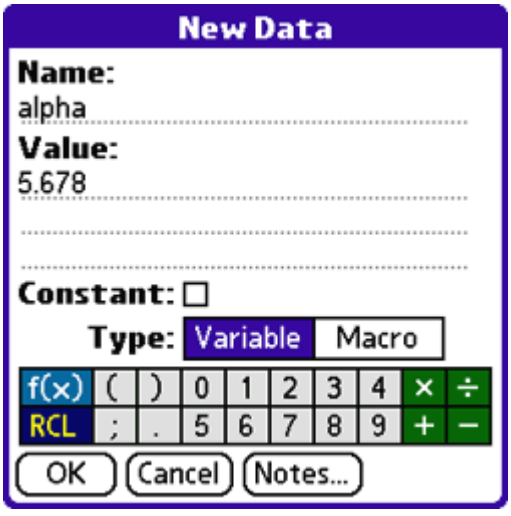
C. Buttons: to create a new data item, select "New" and choose the type of data to create. For more information on each type of data, see its corresponding discussion within this section. To import data, select "Import". See the Sharing Data section for more information. Select "Done" to leave My Data.

1.4.1.1 Variables

Variables are values or sets of values (tables, matrices). When a variable is used in an expression on the entry line, the variable's value is substituted for the variable's name before evaluation. This section discusses single value variables.

New/Edit Variables from My Data

Generally, variables are entered from My Data. Select "New" and choose "Variables" for a new variable. Select a variable from the My Data data list and choose "Edit" to edit a variable. Tables and matrices use a different editor.



A. Name: variable's name. The name consists of letters (capital or lower case) and optionally numbers 0-9. A name cannot start with a number. Note that the name is case sensitive, meaning that variable "abc" is different from variable "ABC". See the Appendix : Restricted Data Names section for names that should not be used.

B. Value: variable's value. Values can be entered either as a number [e.g., 3.5 or 101_b or (3;4)] or as an expression [e.g., 3.5*5^6]. If entered as an expression, it will be evaluated before storing. For instance, if 3.5*5^6 were entered, that variable would be stored as 54,687.5.

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C. Constant/Type: type of data to store. For variables, the Constants checkbox is unchecked and Type is set to "Variable".

D. Keypad: keypad for easy entry. "RCL" displays the memory location list. "f(x)" displays the list of functions organized by category. This is the same as the main calculator's list except category MEM is added (memory store, recall and clear options). See the appropriate Input Modes section for more on which functions are available in each mode. See the Memory & Storage : Memory Locations section for more on recall and store.

E. Buttons: "OK" saves changes while "Cancel" deletes changes, returning to My Data. To enter notes about the data item, select "Notes".

New/Edit Variables from Entry Line

In algebraic and RPN input modes, new variables can be created on the entry line. To create a variable in algebraic input mode, enter the name followed by equals followed by the variable's value. To create a variable in RPN input mode, enter the variable's value followed by enter, followed by the name, and finally select the equals symbol. The equals symbol can be found under the vars category in the function list. For example, to assign the variable "7.565" to the data item alpha, enter the following on the entry line:

algebraic input mode: alpha = 7.565
RPN input mode: 7.565 [ENT] alpha [=]

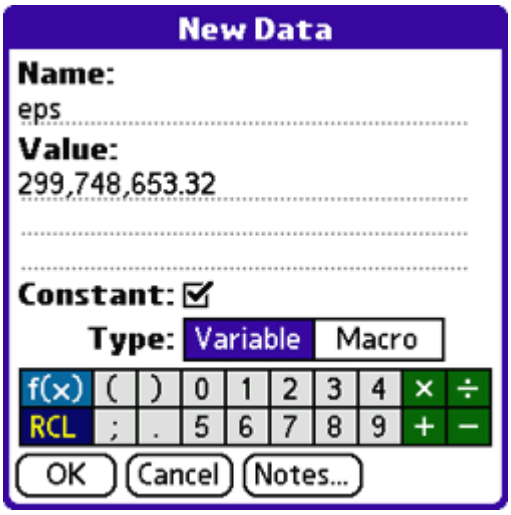
Note that if a variable is already defined as alpha, it will be overwritten with this new definition. Attempting to overwrite a constant will display a warning.

1.4.1.2 Constants

Constants are defined variables or macros that cannot be altered on the entry line. If a new data item is created with the same name as a constant either in My Data or the entry line, a warning will appear before saving the new data. A number of constants are included automatically.

New/Edit Constants from My Data

Constants are entered from My Data. Select "New" and choose "Constant" for a new constant. Select a constant from the My Data data list and choose "Edit" to edit the constant.



A. Name: constant's name. The name consists of letters (capital or lower case) and optionally numbers 0-9. A name cannot start with a number. Note that the name is case sensitive, meaning that constant "abc" is different from constant "ABC". See the Appendix : Restricted Data Names section for names that should not be used.

B. Value: constant's value. Macros are stored as expressions [i.e, 3.5*5^6] while variables are stored as a value. When a macro is used in an equation, the expression is substituted for the macro's name before evaluation.

C. Constant/Type: type of data to store. For macros, the Constants checkbox is unchecked and Type is set to "Macro".

D. Keypad: keypad for easy entry. "RCL" displays the memory location list. "f(x)" displays the list of functions organized by category. This is the same as the main calculator's list except category MEM is added (memory store, recall and clear options). See the appropriate Input Modes section for more on which functions are available in each mode. See the Memory & Storage : Memory Locations section for more on recall and store.

E. Buttons: "OK" saves changes while "Cancel" throws out changes, returning to My Data. To enter notes about the data

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item, select "Notes".

New/Edit Constants from Entry Line

Constants may not be created from the entry line in any input modes. If a variable or macro is defined with the name of an existing constant, a warning will be displayed before storing it.

Included Constants

Function	Display	Value
Speed of Light	c	299,792,458 m/s
Exponential	e	2.71828182846
Elemental Charge	ec	1.60217646E-19 C
Gravity Acceleration	g	9.80665 m/s^2
Gravity Constant	G	6.67259E-11 $m^3/kg\ s^2$
i (Square Root of -1) *	i	(0;1)
Coulomb	k	8,987,551,787.37
Electron Mass	Me	9.10938188E-31 kg
Proton Mass	Mp	1.67262158E-27 kg
Neutron Mass	Mn	1.67492716E-27 kg
Avogadro's Number	NA	6.02214199E23/mol
Pi	pi	3.14159265359
Universal Gas Constant	R	8.314472 J/mol K

* not available in order of operations and chain input modes.

The constant Tolerance is also available. Tolerance is used for derivative, second derivative, function maximum and function minimum when the tolerance is not included in the mathematical function. It defaults to 0.0001

1.4.1.3 Macros

Macros, which are available only in algebraic input mode, are equations. When a macro is used in an expression on the entry line, the text of the macro is substituted for the macro name before evaluation.

New/Edit Macros from My Data

Generally, macros are entered from My Data. Select "New" and choose "Macro" for a new macro. Select a macro from the My Data data list and choose "Edit" to edit the macro.

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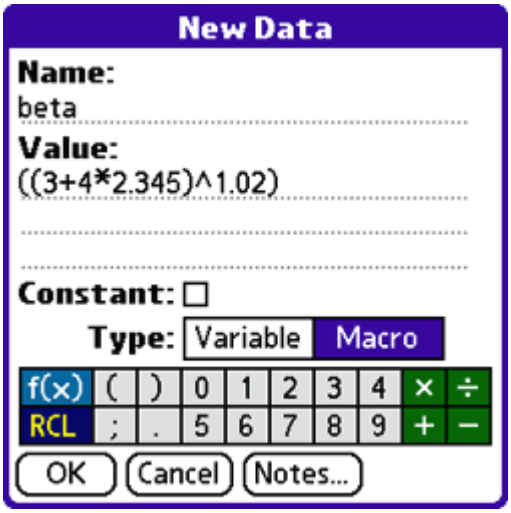
A. Name: macro's name. The name consists of letters (capital or lower case) and optionally numbers 0-9. A name cannot start with a number. Note that the name is case sensitive, meaning that macro "abc" is different from macro "ABC". See the Appendix : Restricted Data Names section for names that should not be used.



B. Value: macro's value. Values can be entered either as a number [i.e, 3.5 or 101_b or (3;4)] or as an expression [i.e, 3.5*5^6]. If entered as an expression and "Variable" is selected, it will be evaluated before storing. For instance, if 3.5*5^6 were entered, that variable would be stored as 54,687.5. If entered as an expression and "Macros" is selected, the expression will be stored. When a macro is used in an equation, the expression is substituted for the macro's name before evaluation.

C. Constant/Type: type of data to store. For constants, the Constants checkbox is checked and Type is set to either "Variable" or "Macro", as desired. See Value for more information.

D. Keypad: keypad for easy entry. "RCL" displays the memory location list. "f(x)" displays the list of functions organized by category. This is the same as the main calculator's list except category MEM is added (memory store, recall and clear options). See the appropriate Input Modes section for more on which functions are available in each mode. See the Memory & Storage : Memory Locations section for more on recall and store.

E. Buttons: "OK" saves changes while "Cancel" deletes changes, returning to My Data. To enter notes about the data item, select "Notes".

New/Edit Macros from Entry Line

In algebraic input mode, new macros can be created on the entry line. To create a macro, enter the name followed by colon followed by equals followed by the macro's value. The colon-equals symbol can be found under the macro category in the function list. For example to assign the macro "-(3*pi)" to the data item beta, enter the following on the entry line:

beta := -(3*pi)

Note that if a macro is already defined as beta, it will be overwritten with this new definition. Attempting to overwrite a constant will display a warning.

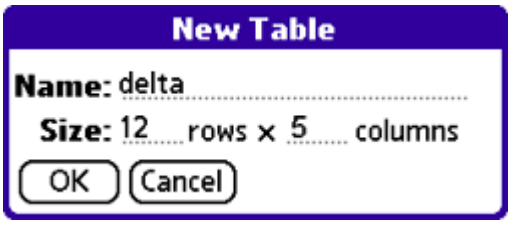
1.4.1.4 Tables

Tables, only available in modes that use an entry line, are values grouped into sets. When a table is used in an expression on the entry line, the table's data is substituted for the table's name before evaluation.

New/Edit Tables from My Data

Generally, tables are entered from My Data. Select "New" and choose "Table" for a new table. Select a table from the My Data list and choose "Edit" to edit the table.

A. Name: table's name. The name consists of letters (capital or lower case) and, optionally, numbers 0-9. A name cannot start with a number. Note that the name is case sensitive, meaning that table "abc" is different from table "ABC". See the Appendix : Restricted Data Names section for names that should not be used.



B. Size: table's row and column dimensions. Rows and columns can also be added in the editor.

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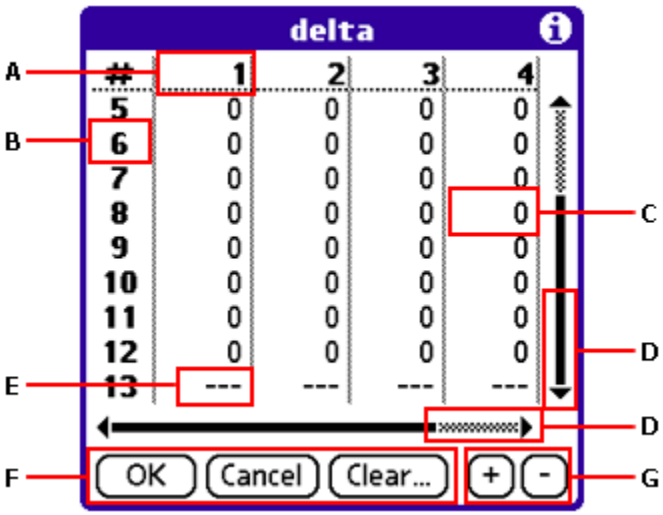
Tables Editor



A. Column Header: the number or name of the column. Select a column header for a list of options:

- Insert: insert a column before the selected one.
- Delete: delete the selected column.
- Clear: clear the contents of the selected column, but does not delete it.
- Move Left: swap the selected column's position with the one to the left.
- Move Right: swap the selected column's position with the one to the right.
- Sort A: sort the entire table by the selected column in ascending order.
- Sort D: sort the entire table by the selected column in descending order.

B. Row Header: the number of the row. Select a row header for a list of options:

- Insert: insert a row before the selected one.
- Delete: delete the selected row.
- Clear: clear the contents of the selected row, but does not delete it.
- Move Up: swap the selected column's position with the one above.
- Move Down: swap the selected column's position with one below.

C. Cell: select a cell to edit its contents. Each cell is referenced by row-column coordinates. In this case, the highlighted cell is 8-4. Use the pop-up calculator to enter data into the table, select checkmark to save or x to cancel. See the Templates : Using Templates : Data Entry section for more information on the pop-up calculator.

D. Scroll Bars: to see additional rows or columns, move the appropriate scroll bar. The scroll bar(s) only appear if there is more than one page of columns or rows. See Expand/Contract Buttons (G) to show more or less data on the screen at one time.

E. New Row: select "---" to enter a new data point at that row. This will create a new row, pushing "---" to the next row.

F. Buttons: select "OK" to save changes and "Cancel" to delete changes and leave the table editor. Select "Clear" to clear the contents of the entire table.

G. Expand/Contract Buttons: select the "+" button to see more columns on the screen at one time and "–" button to see fewer columns on the screen at one time.

H. Menu: select "Import" to import data into the table editor or "Export/Beam" to export or beam data from the table editor. See Sharing Data below for more information. Select "Notes" to enter notes about the table.

New/Edit Tables from Entry Line

In algebraic and RPN input modes, a new table can be created on the entry line. To create a table in algebraic input mode, enter the name followed by equals followed by the table. To create a table in RPN input mode, enter the table followed by enter, followed by the name, and finally select the equals symbol. The equals symbol can be found under the vars category in the function list. Use braces { } to group rows and columns.

For example, to assign the table with elements {3;4;5;6} to the data item delta, enter the following on the entry line:

algebraic input mode: delta = {3;4;5;6}

RPN input mode: {3;4;5;6} [ENT] delta [=]

Note that if a function or variable is already defined as delta, that version will be overwritten with this new definition. Attempting to overwrite a constant will display a warning.

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The previous example created a data item, delta, defined to be a table with a single column. To create a table with multiple columns, create each row in braces, separate the rows with semi-colons, and place braces around all rows. For example, table

1	2
3	4

would be written as { {1;2} ; {3;4} }.

Sharing Table Data

To share table data, go to the menu in the Table Editor.

Two data export/beam options come with the software:

- **Write array to Memo Pad:** save the data as a comma delimited file in the Memo Pad. Large data is automatically saved as multiple Memo Pad files.
- **Copy array to clipboard:** copy the data as a comma delimited file to the system clipboard so it can be pasted into another software application on the device.

One data import option comes with the software:

- **Paste array from clipboard:** paste comma-delimited data from the system clipboard into the Table Editor.

Infinity Softworks may offer additional export/beam and import plug-ins from its web site. These plug-ins could include ones to communicate with word processors, spreadsheets and probe systems, among others. See the Plug-ins web page at www.infinitysw.com/graph for more information.

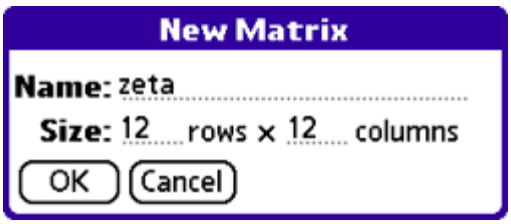
1.4.1.5 Matrices

Matrices, only available in modes that use an entry line, are values grouped into sets. When a matrix is used in an expression on the entry line, the matrices' data is substituted for the matrices' name before evaluation.

New/Edit Matrices from My Data

Generally, matrices are entered from My Data. Select "New" and choose "Matrix" for a new matrix. Select a matrix from the My Data list and choose "Edit" to edit the matrix.

A. Name: matrices' name. The name consists of letters (capital or lower case) and, optionally, numbers 0-9. A name cannot start with a number. Note that the name is case sensitive, meaning that table "abc" is different from table "ABC". See the Appendix : Restricted Data Names section for names that should not be used.



B. Size: matrices' row and column dimensions. Rows and columns can also be added in the editor.

Matrix Editor

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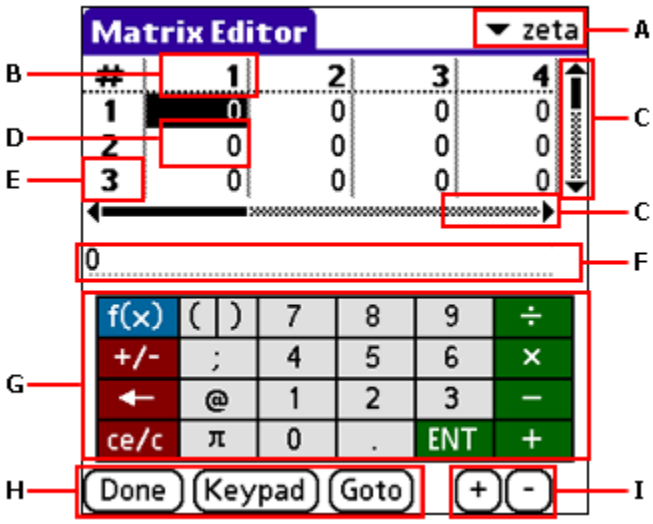

A. Matrix List: shows the name of the currently visible matrix. Select it to show a list of other created matrices. Switch to an alternative matrix by selecting its name from the list.

B. Column Header: the number of the column. Select a column header for a list of options:

- Insert: insert a column before the selected one.
- Delete: delete the selected column.
- Clear: clear the contents of the selected column, but does not delete it.
- Move Left: swap the selected column's position with the one to the left.
- Move Right: swap the selected column's position with the one to the right.

C. Scroll Bars: to see additional rows or columns, move the appropriate scroll bar. The scroll bar(s) only appear if there is more than one page of columns or rows. See Expand/Contract Buttons (H) to show more or less data on the screen at one time.

D. Cell: select a cell to edit its contents. Each cell is referenced by row-column coordinates. In this case, the highlighted cell is 2-1. Enter data on the entry line (F).

E. Row Header: the number of the row. Select a row header for a list of options:

- Insert: insert a row before the selected one.
- Delete: delete the selected row.
- Clear: clear the contents of the selected row, but does not delete it.
- Move Up: swap the selected column's position with the one above.
- Move Down: swap the selected column's position with one below.

F. Entry Line: the enter line appears when a cell is selected, either as pictured above if the keyboard is visible or at the bottom of the screen if the keyboard is hidden. Enter data on the entry line. To evaluate the entry and store that data in the cell, move to another cell or select the enter button.

G. Keypad: keypad for easy entry. The keypad may not be tapped unless a cell is selected. "f(x)" displays the list of functions organized by category. This is the same as the main calculator's list except category MEM is added (memory store, recall and clear options). Select "ENT" to evaluate the data and move to the next cell. See the appropriate Input Modes section for more on which functions are available in each mode. See the Memory & Storage : Memory Locations section for more on recall and store.

H. Buttons: select "Done" to save changes and leave the matrix editor. Select "Keypad" to show or hide the keypad. Hiding the keypad shows more of the matrix. Select "Goto" to go to a specific cell.

I. Expand/Contract Buttons: select the "+" button to see more columns on the screen at one time and "–" button to see less columns on the screen at one time.

J. Menu: select "New" to create a new matrix. Select "Details" to see the name and row/column information about the current matrix. Select "Preferences" to see a list of matrix editor preferences. These preferences are the same as those outlined in the Using the Calculator : Preferences section except "Frac. Mode" (fraction mode). Choose "Fraction" to see the matrix elements as fractions, choose "Decimal" to see the elements as floating point numbers, or choose "Mix Fraction". Select "Import" to import data into the matrix editor or "Export/Beam" to export or beam data from the matrix editor. See Sharing Data below for more information. Select "Notes" to enter notes about the table. Select "Notes" to enter notes about the matrix. Select "Help" for online help regarding the matrix editor.

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New/Edit Matrices from Entry Line

In algebraic and RPN input modes, new matrices can be created on the entry line. To create a matrix in algebraic input mode, enter the name followed by equals followed by the matrix. To create a matrix in RPN input mode, enter the matrix followed by enter, followed by the name, and finally select the equals symbol. The equals symbol can be found under the vars category in the function list. Use brackets [ ] to group rows and columns.

For example, to assign the matrix with elements [3;4;5;6] to the data item zeta, enter the following on the entry line:

algebraic input mode: zeta = [3;4;5;6]
RPN input mode: [3;4;5;6] [ENT] zeta [=]

Note that if a function or variable is already defined as zeta, it will be overwritten with this new definition. Attempting to overwrite a constant will display a warning.

The previous example created a data item, zeta, defined to be a matrix with a single column. To create a matrix with multiple columns, create each row in brackets, separate the rows with semi-colons, and place brackets around all rows. For example, the matrix

1	2
3	4

would be written as [[1;2] ; [3;4]].

Sharing Matrix Data

To share matrix data, go to the menu in the Matrix Editor.

Two data export/beam options come with the software:

- **Write array to Memo Pad:** save the data as a comma delimited file in the Memo Pad. Large data is automatically saved as multiple Memo Pad files.
- **Copy array to clipboard:** copy the data as a comma delimited file to the system clipboard so it can be pasted into another software application on the device.

One data import option comes with the software:

- **Paste array from clipboard:** paste comma-delimited data from the system clipboard into the Matrix Editor.

Infinity Softworks may offer additional export/beam and import plug-ins from its web site. These plug-ins could include ones to communicate with word processors, spreadsheets and probe systems, among others. See the Plug-ins web page at www.infinitysw.com/graph for more information.

1.4.1.6 Sharing Data

Import and Export/Beam options are available for different types of data, graphs and templates. This section discusses sharing the entire data item (variables, constants, macros, matrices and tables) including names and notes. The Matrix Editor and Table Editor offer additional data sharing options specifically regarding comma delimited data. See their corresponding sections for more information.

Export/Beam

To export or beam a data item:

- Go to My Data.
- Select the data item to share.
- Choose "Export/Beam" from the list. Export/Beam Options appears.
- Select the desired export/beam option.
- Follow the on-screen directions, if any are required.

Two data export/beam options come with the software:

- **Export data item to file:** save the selected data item in a file that can be synchronized to the desktop for archival or sharing purposes.

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- **Beam data item:** beam the selected data item to another handheld that has this software.

Infinity Softworks may offer additional export/beam plug-ins from its web site. These plug-ins could include ones to communicate with word processors, spreadsheets and probe systems, among others. See the Plug-ins web page at www.infinitysw.com/graph for more information.

Import

To import a data item:
- Go to My Data.
- Select "Import" at the bottom of My Data.
- Select the desired import option.
- Follow the on-screen directions, if any are required.

One data import option comes with the software:
- **Import data items from files:** find data item files and import them. Generally, data items are imported automatically when the software is first started. However, the expansion memory is not searched. Choose this option to import from both device and expansion memory.

Infinity Softworks may offer additional import plug-ins from its web site. Those plug-ins could include ones to communicate with word processors, spreadsheets and probe systems, among others. See the Plug-ins web page at www.infinitysw.com/graph for more information.

1.4.2 Memory Locations

There are 10 memory locations available. Memory locations can be accessed one of two ways, depending on the skin. In some skins, select "MEM" and either "Store" or "Recall". In other skins, select "RCL" or "STO" (or "r" or "s") buttons. See the Using the Calculator : Interface Overview section for information on accessing these locations. The same memory locations are available in the main and pop-up calculators.

When storing, the contents of the entry line/view window will be stored to the selected memory location. In algebraic and RPN input mode, any pending calculation will be performed before storing, although the entry line is not altered. For order of operations and chain input modes, it stores only the visible value in the view window.

When recalling in algebraic and RPN input modes, the value will be placed in the entry line at the current cursor position. When recalling in order of operations and chain, the value will overwrite the contents of the view window.

It is possible to perform arithmetic operations on a value that is being stored to memory using existing values in memory. This allows values from the entry line/view window to be added to or subtracted from a current value in memory, as well as several other operations. Note that operations performed on memory locations do not affect the contents of the entry line.

The following table describes the operations that can be performed on memory locations, where 'value' refers to the contents of the entry line/view window while memory location means the contents of a selected memory location. Calculations are performed as follows:

Operand	Functionality
=	Overwrites the selected memory location with the value.
+	The memory location plus the value
–	The memory location minus the value
x	The memory location multiplied by the value
÷	The memory location divided by the value
y^x	The memory location to the value's power.

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For example, to add the last calculated result to memory location 2:

- select "MEM" then "Store" (or the "STO" button, depending on the skin in use)
- tap "+"
- tap memory location 2

Clearing memory locations also depends on the skin. If the skin has a "MEM" button, select this button and choose "Clear". Alternatively, select "Clear Memory" from the Options menu. See the Using the Calculator : Interface Overview : Menus section for more information.

1.4.3 System Clipboard

The system clipboard can be used to store values or move information from one application to another.

In algebraic and RPN input modes, highlight the data to save to the clipboard and choose an appropriate function from the Edit menu (or Copy or Paste by selecting the "powerOne" button). In order of operations and chain input modes, select an appropriate function from the Edit menu (or Copy or Paste by selecting the "powerOne" button). The view window's value will be the target.

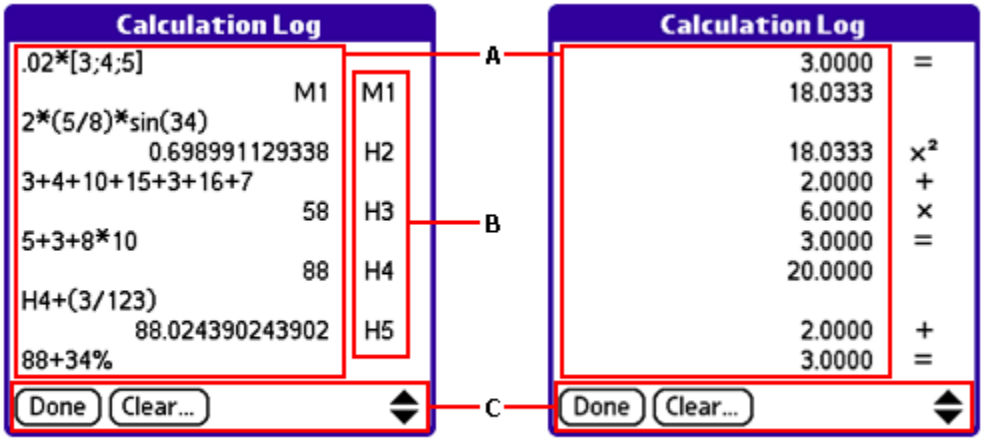
1.4.4 History List

The history list is available in order of operations and chain input modes. Each time the equals button is selected, a new history item is stored. The software stores the last 10 recorded answers.

To display the history list, select "history" from the function list. To recall a value from the history list to the view window, select it. The last entry recorded in the history list can also be recalled by using the "Last" function.

1.4.5 Calculation Log

The calculation log is used to display computations as they are entered. Even if the calculator input is cleared, the calculation log retains a history of the last calculations. To access the calculation log, see the Using the Calculator : Interface Overview.



algebraic input mode RPN, order and chain input modes

A. Equation/Value: algebraic input mode offers a different interface than the other modes. Algebraic mode functions similar to the main calculator's view window for the same mode. The window is broken into sets of two with the top line as the last equation entered and the lower line as the last calculation. To recall the last equation entered to the entry line, select it. To recall the value as the number of decimal places displayed on the screen, select the last answer's value. For all other input modes, selecting the value returns it to the entry line/view window for use in the calculation.

B. Location Designation: only available in algebraic input mode, selecting the location designation (H1 in this picture) does one of three things. If the designation starts with H, selecting it recalls the full precision to the entry line for use in the

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calculation. If the designation starts with M, selecting it displays the matrix editor. If the designation starts with T, selecting it displays the table editor.

C. Additional Functionality: in all modes, select "Clear" to clear the calculation log, select the scroll arrows to scroll up and down, or select "Done" to exit the calculation log. Switching input modes also clears the calculation log automatically.

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2 Types of Data

When working with data, it is important to understand that data comes in various forms. This section outlines the core data types, how they are used, and what functions are available for each. The Function List section discusses each function in more depth and its relationship to the appropriate data types.

2.1 Booleans

Booleans, only available in modes that use an entry line, are either true or false and are used when comparing two items or logic functions.

See Subject Areas : Booleans for more information.

2.2 Integers (Whole Number)

Integers are whole numbers, numbers without a fractional part. Numbers such as 3, -45, and 0 are integers. Integer numbers are generally in the range –2,147,483,648 to 2,147,483,647 or -2^{31} to $2^{31}-1$.

2.3 Base Numbers

Base numbers, only available in modes that use an entry line, are integers expressed in a different number base. In every day mathematics, whole numbers (integers) are decimals. Decimals are base 10, meaning a value is comprised of columns of numbers 0 through 9. For example, the number 87 is made up of an 8 and a 7. Binary (base 2), octal (base 8) and hexadecimal (base 16) are also available.

- **Binary:** base 2 numbers, the suffix "_b" designates that the number is binary. Binary values consist of numbers 0 and 1. To designate the number 101 as binary, enter "101_b" (without quotation marks).
- **Octal:** base 8 numbers, the suffix "_o" designates that the number is octal. Octal values consist of numbers 0 through 7. To designate the number 37 as octal, enter "37_o" (without quotation marks).
- **Decimal:** base 10 numbers, the suffix "_d" designates that the number is decimal. Decimal values consist of numbers 0 through 9. To designate the number 53 as decimal, enter "53_d" (without quotation marks).
- **Hexadecimal:** base 16 numbers, the suffix "_h" designates that the number is hexadecimal. Hexadecimal values consist of numbers 0 through 9 and letters A through F. To designate the number 5A as hexadecimal, enter "5A_h" (without quotation marks). To designate the number BF as hexadecimal, enter "0BF_h" (without quotation marks, note that a hexadecimal value must start with a number so it is not confused with a variable, constant or function).

See Subject Areas : Base Numbers for more information.

2.4 Floating Point Numbers

Floating point numbers are numbers with a fractional portion. Numbers such as 3.5, -75.235 and 1E-2 are floating point numbers. The number 3.0 is also a floating point number because of the .0 portion -- if it were written as 3 it would be an integer number. Floating point numbers are in the range 1E308 to -1E308.

If the input mode allows, the base-fraction mode should be set to decimal, fraction or mixed fraction. In decimal mode, answers are returned as floating point numbers or integers. In fraction and mixed fraction mode, answers are returned as fractions. In other modes, the entries are rounded before proceeding. See the appropriate section in Using the Calculator : Input Modes for more information on base-fraction modes.

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2.5 Fractions

Fractions, only available in modes that use an entry line, are floating point numbers expressed with a numerator, denominator and sometimes an integer (whole number). There are two types of fractions:

- **Fractions:** also referred to as irregular fractions, consist of a numerator and denominator. Examples are 3/5 and 56/2. It is recommended that fractions be enclosed in parentheses. An example is "(3/5)" (without quotation marks).
- **Mixed Fractions:** consist of a whole number, numerator and denominator. Examples are 15 1/2 and 1 3/5. Separate the whole number from the fraction with a plus symbol. It is recommended that mixed fractions be enclosed in parentheses. An example is "(1+3/5)" (without quotation marks).

See Subject Areas : Fractions for more information.

2.6 Dates & Times

Dates, only available in modes that use an entry line, refer to both month-day-year and time of day. There are two formats:

- **Date:** day-month-year entered as dd.mmyyyy, a 2-digit day, 2-digit month and 4-digit year. Years must be between 1900 and 3000. An example is September 27, 1987. This would be entered as "27.091987" (without quotation marks).
- **Time:** hour-minute-second-millisecond entered in hh.mmssmmm format, 2-digits each for hour, minute and second and 3-digits for millisecond. Hours should be entered in military time (0-23 hours). For example, 11:05am would be entered as "11.05" while 11:05 pm would be entered as "23.05" (without quotation marks in both examples).

See Subject Areas : Dates & Times for more information.

2.7 Complex Numbers

Complex numbers, only available in modes that use an entry line, consist of two floating point numbers that specify real and imaginary parts. Both rectangular and polar complex numbers can be used. Rectangular and polar formats are as follows:

- **Rectangular:** (real; imaginary) or (real + imaginary *i)
- **Polar:** (r; @θ) or (r * e^(θ*i))

The "@" symbol denotes polar format. If a mathematics function cannot return a number value, it will attempt to return a complex value instead. For example, asin(-2) will return radians (2.05; @2.44) [degrees will return (2.05; @140.02)] in polar mode or (-1.57; 1.32) in rectangular mode. See the Using the Calculator : Preferences section for more on complex number preferences.

See Subject Areas : Complex Numbers for more information.

2.8 Tables & Lists

Tables, only available in modes that use an entry line or from the templates, are a series of data (rows) organized into multiple columns. A list is a table with only one column. See the Using the Calculator : Memory & Storage : My Data section for more on creating tables.

See Subject Areas : Tables for more information.

2.9 Matrices & Vectors

Matrices, only available in modes that use an entry line, are a series of numbers (rows) organized into multiple columns where there are the same number of elements in each row. A vector is a matrix with only one column. See the Using the

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Calculator : Memory & Storage : My Data section for more on creating matrices.

See Subject Areas : Matrices for more information.

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3 Subject Areas

3.1 Base Numbers

See Types of Data : Base Numbers for a detailed definition.

Base numbers, available in algebraic and RPN input mode only, can be used in any function or with any operand that uses integers. The following functions are commonly used specifically with base numbers (category in bold):

dev			
~x	_b	→b	A
&	_o	→o	B
|	_d	→d	C
#	_h	→h	D
<<			E
>>			F

Examples:

Each example assumes the base-fraction mode is set to decimal. See the appropriate Using the Calculator : Input Modes section for more information on setting the base-fraction mode.

53 + 23 returns 76 (decimal)

23_d + 101_b returns 28 (decimal)

0A5_h + 5F_h →d returns 260_d (decimal)

0A5_h + 5F_h →h returns 0104_h (hexadecimal)

1011_b << 2 →b returns 101100_b (binary)

If the base-fraction mode is set to binary, octal or hexadecimal, numbers are entered in that mode by default and answers will return in that format. For example, if the mode is set to hexadecimal:

53_d + 23_d returns 04C_h (hexadecimal)

23_d + 101_b returns 01C_h (hexadecimal)

0A5 + 5F →d returns 260_d (decimal)

See the Functions section for additional information on each function.

3.2 Boolean

See Types of Data : Boolean for a detailed definition.

Boolean values, available in algebraic and RPN input modes, can be used in many functions and operands that uses integers. The following functions are commonly used specifically with Boolean values (category in bold):

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bool	
==	!x
<>	&&
<	||
>	##
<=	if
>=	choose

Examples:

3.5 < 5 returns true

3.5 > 5 returns false

if (5 <= x; 25; 75) returns 25 if 5 is less than or equal to x, otherwise it returns 75

if (x > 3 && x < 15; 0; 20) returns 0 if x is greater than 3 and less than 15, otherwise it returns 20

See the Functions section for additional information on each function.

3.3 Calculus

The following functions are commonly used in Calculus mathematics (category in bold):

calc	
'x'	fnInt
" "	fMax
nDeriv	fMin
nDeriv2	

See the Functions section for additional information on each function.

3.4 Complex Numbers

See Types of Data : Complex Numbers for a detailed definition.

The following functions are commonly used with complex numbers (category in bold):

cmplx	
i	real
@	theta
conj	toRect
imag	toPolar

See the Functions section for additional information on each function.

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3.5 Dates & Times

See Types of Data : Date for a detailed definition.

The following functions are commonly used with date and time mathematics (category in bold):

date	
adjDate	getDate
adjTime	getTime
makeDate	HRS
weekDay	HMS
dDays	today

See the Functions section for additional information on each function.

The following templates are commonly used with data and time calculations (category in bold):

Calendar
Date
Time

See the Templates : Included Templates section for additional information on each template. See Infinity Softworks' web site for additional templates: www.infinitysw.com/graph

3.6 Distribution

The following functions are commonly used with distribution mathematics (category in bold):

distr			
nDist	PoissonCDF *	GeometCDF *	fCDF *
invNorm	PoissonPDF *	GeometPDF *	fPDF *
BinomCDF *	NormalCDF *	tCDF *	chiCDF *
BinomPDF *	NormalPDF *	tPDF *	chiPDF *

See the Functions section for additional information on each function.

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3.7 Finance & Business

The following functions are commonly used with finance and business math (category in bold):

finance						
IntEff	USPV	TvmPV	DepSLBV	DepDBSLDA	DepSOYDDV	CfoNUS
IntNom	TvmFV	BondP	DepSLDV	DepDBSLBV	CdoNPV	CfoPbk
SPFV	TvmI	BondY	DepDBDA	DepDBSLDV	CfoIRR	CfoProf
SPPV	TvmN	BondA	DepDBBV	DepSOYDDA	CfoNFV	CfoTot
USFV	TvmPmt	DepSLDA	DepDBDV	DepSOYDBV	CfoMIRR	CfoCount

See the Functions section for additional information on each function.

The following templates are commonly used with finance and business calculations (category in bold):

Business
Discount
Markup
Prec Change
Sales Tax
Tip
TVM

See the Templates : Included Templates section for additional information on each template. See Infinity Softworks' web site for additional templates: www.infinitysw.com/graph

3.8 Fractions

See Types of Data : Fractions for a detailed definition.

Fractions, available in algebraic and RPN input mode, can be used in any function or with any operand that uses floating point numbers. The following functions are commonly used specifically with fractions (category in bold):

number
→frac
→mFrac

Examples:
Each example assumes the base-fraction mode is set to decimal. See the appropriate Using the Calculator : Input Modes section for more information on setting the base-fraction mode.

(3/5) returns 0.6

(7/2) returns 3.5

(1/6) + (2/6) returns 0.5

0.8 →frac returns (4/5)

2.5 →frac returns (5/2)

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(1/6) + (2/6) →frac returns (1/2)

If the base-fraction mode is set to fraction:

(3/5) returns (3/5)

(1/5) + (2/5) returns (3/5)

0.8 returns (4/5)

2.5 returns (5/2)

If the base-fraction mode is set to mixed fraction:

(3/5) returns (3/5)

(7/2) returns (3+1/2)

(2/9) + (2+5/9) returns (2+7/9)

0.8 returns (4/5)

2.5 returns (2+1/2)

See the Functions section for additional information on each function.

3.9 Matrices

See Types of Data : Matrices & Vectors for a detailed definition.

The following functions are commonly used with matrices (category in bold):

matrix					
[ ] (mtrx)	trans	cond	row+	append	getCol
{ } (tbl)	identity	cross	row*	redim	sortA
x^{-1}	cumSum	dot	*row+	dim	sortD
det	norm	min	fill	getItem	subList
ref	rNorm	max	augment	getRow	toTable
rref	cNorm	rowSwap			

See the Functions section for additional information on each function.

3.10 Probability

The following functions are commonly used with probability mathematics (category in bold):

prob	
nPr	randT
nCr	randTInt
x!	RandNorm *
rand	RandBin *
randInt	

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See the Functions section for additional information on each function.

3.11 Statistics

The following functions are commonly used with statistics (category in bold):

stats		
{ } (tbl)	median	variance
countX	min	varianceP
sumX	max	sigma
sumX2	stdDev	seq
mean	stdDevP	prod

See the Functions section for additional information on each function.

The following templates are commonly used with statistics calculations (category in bold):

Stats			
1-Prop ZInt	2-Sample FTest	2-Var Stats	T-Test
1-Prop ZTest	2-Sample TInt	ANOVA	T Interval
1-Var Stats	2-Sample TTest	Chi^2 Test	Z-Test
2-Prop ZInt	2-Sample ZInt	LinReg TTest	Z Interval
2-Prop ZTest	2-Sample ZTest	Regression	

See the Templates : Included Templates section for additional information on each template. See Infinity Softworks' web site for additional templates: www.infinitysw.com/graph

3.12 Tables

See Types of Data : Tables & Lists for a detailed definition.

The following functions are commonly used with tables (category in bold):

stats		
{ } (tbl)	mean	stdDev
countX	median	stdDevP
sumX	min	variance
sumX2	max	varianceP

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matrix					
{ } (tbl)	norm	max	fill	dim	sortA
x^{-1}	rNorm	rowSwap	augment	getItem	sortD
trans	cNorm	*row+	append	getRow	subList
cumSum	min	row+	redim	getCol	toMatrix

See the Functions section for additional information on each function.

3.13 Trigonometry

The following functions are commonly used specifically with trigonometric mathematics (category in bold):

trig					
sin	asin	sinh	asinh	sec	degrees
cos	acos	cosh	acosh	csc	radians
tan	atan	tanh	atanh	cot	

See the Functions section for additional information on each function.

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4 Functions

4.1 Symbol Chart

This section outlines common symbols and their equivalents within this software. For more on each function, look for the Function Name in alphabetical order in this section.

Symbol	Function Name
–	Subtraction
.	Decimal Separator
,	Decimal Separator
!=	Not Equal
!x	Not
" "	Quotation Marks
#	Exclusive Or
##	Exclusive Or
%x	Percent
&	And
&&	And
( )	Parentheses
*	Multiplication
*row+	Row Add & Multiply
/	Division
÷	Division
:=	Colon-Equals
;	Semi-Colon
@	Degrees Symbol
[ ] (mtrx)	Brackets
_b	Binary
_d	Decimal
_h	Hexadecimal
_o	Octal
{ } (tbl)	Braces
|	Or
||	Or
~x	Not
+	Addition
+/–	Sign

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<	Less Than
<<	Shift Left
<=	Less Than or Equal To
<>	Not Equal
=	Equals
==	Equals
>	Greater Than
>=	Greater than or Equal To
>>	Shift Right
^	Power
←	Backspace
→b	Binary, Display As
→d	Decimal, Display As
→frac	Fraction, Display As
→h	Hexadecimal, Display As
→mFrac	Mixed Fraction, Display As
→o	Octal, Display As
√x	Square Root
$\sqrt[3]{x}$	Cubed Root
$\sqrt[y]{x}$	Root
1/x	Reciprocal
10^x	Power of 10
abs	Absolute Value
abs	Rectangular to Polar Conversion
acos	Arc-Cosine
acosh	Hyperbolic Arc-Cosine
adjDate	Adjust Date
adjTime	Adjust Time
append	Append
asin	Arc-Sine
asinh	Hyperbolic Arc-Sine
atan	Arc-Tangent
atanh	Hyperbolic Arc-Tangent
augment	Augment
BinomCDF *	Binomial Cumulative Distribution

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BinomPDF *	Binomial Probability Distribution
BondA *	Bond Accrued Interest
BondP *	Bond Price
BondY *	Bond Yield
cbrt	Cubed Root
CE/C	Clear
ceil	Ceiling
CfoCount *	Count
CfoIRR *	Internal Rate of Return
CfoMIRR *	Modified Internal Rate of Return
CfoNFV *	Net Future Value
CfoNPV *	Net Present Value
CfoNUS *	Net Uniform Series
CfoPbk *	Payback
CfoProf *	Profitability Index
CfoTot *	Total
chiCDF *	Chi-Squared Cumulative Distribution
chiPDF *	Chi-Squared Probability Distribution
choose	Choose
Clear	Memory
cNorm	Column Norm
cond	Condition
conj	Conjugate
cos	Cosine
cosh	Hyperbolic Cosine
cot	Cotangent
countX	Occurrences
cross	Cross Product
csc	Cosecant
cumSum	Cumulative Sum
dDays	Difference Between Dates
degrees	Radians to Degrees Conversion
degs	DMS to Degrees Conversion
DepDBBV *	Declining Balance Depreciation
DepDBDA *	Declining Balance Depreciation

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DepDBDV *	Declining Balance Depreciation
DepDBSLBV *	Declining Balance Crossover Depreciation
DepDBSLDA *	Declining Balance Crossover Depreciation
DepDBSLDV *	Declining Balance Crossover Depreciation
DepSLBV *	Straight Line Depreciation
DepSLDA *	Straight Line Depreciation
DepSLDV *	Straight Line Depreciation
DepSOYDBV *	Sum of the Year's Digits Depreciation
DepSOYDDA *	Sum of the Year's Digits Depreciation
DepSOYDDV *	Sum of the Year's Digits Depreciation
det	Determinant
dim	Dimension
dms	Degrees to DMS Conversion
dot	Dot Product
drop	Stack
dup	Stack
e^x	Exponential
EE	Exponent
ENTER	Enter
fCDF *	F Cumulative Distribution
fill	Fill
floor	Floor
fMax	Maximum, Function
fMin	Minimum, Function
fnInt	Integral
fPart	Fractional Part
fPDF *	F Probability Distribution
gcd	Greatest Common Denominator
GeometCDF *	Geometric Cumulative Distribution
GeometPDF *	Geometric Probability Distribution
getCol	Get Column
getDate	Get Date in Decimal Format
getItem	Get Item
getRow	Get Row
getTime	Get Time in Decimal Format

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history	History
HMS	Get Hours in HH.MMSS Format
HRS	Get Hours in Decimal Format
i	Complex Number Constant
identity	Identity
if	If
imag	Polar to Rectangular Conversion
IntEff	Effective Interest Rate
IntNorm	Nominal Interest Rate
invNorm	Inverse Cumulative Normal Distribution
iPart	Integer Part
last	Last
lcm	Least Common Multiple
ln	Natural Logarithm
log	Logarithm
makeDate	Make Date from Decimal Format
max	Maximum
mean	Mean
median	Median
MEM	Memory
min	Minimum
mod	Modulo Division
move	Stack
nCr	Combinations
nDeriv	Derivative
nDeriv2	Derivative, Second
nDist	Cumulative Normal Distribution
norm	Frobenius Norm
NormalCDF *	Normal Cumulative Distribution
NormalPDF *	Normal Probability Distribution
normSDist	Cumulative Standard Normal Distribution
nPr	Permutations
PoissonCDF	Poisson Cumulative Distribution
PoissonPDF *	Poisson Probability Distribution
prod	Product
quartile1	1st Quartile
quartile3	3rd Quartile

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radians	Degrees to Radians Conversion
rand	Random Number
RandBin *	Random Binomial Test
randInt	Random Integer
RandNorm *	Random Normal
randT	Random Table
randTInt	Random Table of Integers
RCL	Memory
real	Polar to Rectangular Conversion
redim	Redimension
Recall	Memory
ref	Row-Echelon Form
rnd	Round
rNorm	Row Norm
root	Root
rot	Stack
row*	Row Multiplication
row+	Row Addition
rowSwap	Swap Rows
rref	Reduced Row-Echelon Form
rrot	Stack
sec	Secant
seq	Sequence Evaluation
show	Show
sigma	Sigma
sign	Sign
sin	Sine
sinh	Hyperbolic Sine
solve	Solve
solving	Solving
sortA	Sort Ascending
sortD	Sort Descending
SPFV	Single Payment Future Value
SPPV	Single Payment Present Value
sqrt	Square Root

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stack	Stack
stdDev	Standard Deviation
stdDevP	Standard Deviation
STO	Memory
Store	Memory
subList	Sub List
sumX	Summation
sumX2	Sum of x-Squared
swap	Stack
tan	Tangent
tanh	Hyperbolic Tangent
tCDF *	Student-t Cumulative Distribution
theta	Rectangular to Polar Conversion
toBool	Boolean, Convert To
today	Today
toFloat	Floating Point, Convert To
toInt	Integer, Convert To
toMatrix	Table to Matrix Conversion
toPolar	Polar, Convert To
toRect	Rectangular, Convert To
toTable	Matrix to Table Conversion
tPDF *	Student-t Probability Distribution
trans	Transpose
TvmFV *	Future Value
TvmI *	Interest Rate
TvmN *	Periods
TvmPmt *	Payment
TvmPV *	Present Value
USFV *	Uniform Series Future Value
USPV *	Uniform Series Present Value
variance	Variance
varianceP	Variance
weekDay	Day of Week
x	Multiplication
x!	Factorial
x^{-1}	Inverse
x^{2}	Square
xth root	Root
y^{x}	Power

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* available in an add-on library only

4.2 A-B

This section covers functions beginning with the letters A through B.

4.2.1 Absolute Value

abs(valueA)

Returns absolute value of valueA.

Data Types: integer, floating point, complex, table, matrix. Note: certain combinations do not work.

Category: number

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  abs(-15.6) : returns 15.6

  abs((5; 1.4142)) : returns 5.1961

  abs({ {-15; 22}; {8; -89} }) : returns { {15; 22}; {8; 89} }
  See Rectangular to Polar Conversion for more information.

- Order of Operations and Chain Input Modes

  15.6 +/- abs : returns 15.6

- RPN Input Mode

  15.6 ENT +/- abs : returns 15.6

  (5; 1.4142) abs : returns 5.1961

  { {-15; 22}; {8; -89} } abs : returns { {15; 22}; {8; 89} }

4.2.2 Addition

valueA + valueB

Returns valueA plus valueB.

Data Types: boolean, integer, floating point, date, complex, table, matrix. Note: certain combinations do not work.

Category: not applicable

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  5 + 4 : returns 9

  3.2 + 4.6 : returns 7.8

  [[15; 3]; [6; 82]] + [[12; 23]; [41; 106]] : returns [[27; 26]; [47; 188]]

  (3; 2.4495) + (5; 1.4142) : returns (8; 3.8637)

- Order of Operations and Chain Input Modes

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4 + 5 = : returns 9

3.2 + 4.6 = : returns 7.8

- RPN Input Mode

  4 ENT 5 + : returns 9

  3.2 ENT 4.6 + : returns 7.8

  [[15; 3]; [6; 82]] ENT [[12; 23]; [41; 106]] + : returns [[27; 26]; [47; 188]]

  (3; 2.4495) ENT (5; 1.4142) + : returns (8; 3.8637)

4.2.3 Adjust Date

adjdate(date; days)

This function can only be used within a formula – the returned value cannot be viewed in a template. Returns a date type containing date plus or minus a number of days. date is a date type or a double containing the date in dd.mmyyyy format.

Category: date

Input Modes: algebraic

Examples:

adjDate(today(); -6) : returns 7/26/03 3:15 pm given today's date of 08/01/03 at 3:15 in the afternoon.

adjDate(today(); 2.5) : returns 8/4/03 03:15 am given today's date of 08/01/03 at 3:15 in the afternoon.

adjdate(date; days; months; years)

Same as above except adds months and years to the calculation.

Category: date

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  adjDate(01.082003; 6; 2; 2) : returns 10/7/05 12:00 am.

- RPN Input Mode

  01.082003 ENT 6 ENT 2 ENT 2 adjDate : returns 10/7/05 12:00 am.

4.2.4 Adjust Time

adjtime(date; hours)

This function can only be used within a formula – the returned value cannot be viewed in a template. Returns a date type containing date plus or minus a number of hours. date is a date type, or a value in dd.mmyyyy format.

Category: date

Input Modes: algebraic

Examples:

adjTime(today(); -15) : returns 8/1/03 12:30 am given today's date of 08/01/03 at 3:30 in the afternoon.

adjTime(today(); 4.25) : returns 8/1/03 7:45 pm given today's date of 08/01/03 at 3:30 in the afternoon.

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adjtime(date; hours; minutes; seconds)

Same as above except adds minutes and seconds to the calculation.

Category: date

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  adjTime(01.082003; 352; 6; 30) : returns 8/15/03 4:06 pm given a start time of 12:00 am on 08/01/2003

- RPN Input Mode

  01.082003 ENT 352 ENT 6 ENT 30 adjTime : returns 8/15/03 4:06 pm given a start time of 12:00 am on 08/01/2003

4.2.5 Amortization, End Balance

AmEndBal(period; PV; FV; I%; PMT; N)

Returns the ending principal balance of the given period. This function is only available if p1 Finance Lib is installed.

- **period:** the period to calculate the ending principal balance.
- **PV:** present value. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **FV:** future value. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **I%:** yearly interest rate expressed as a percentage.
- **PMT:** periodic payment amount. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **N:** total number of periods.

Category: finance

Input Modes: algebraic

Examples:

AmEndBal(240; 150000; 0; 6; -899.325; 360) : returns 81,003.52

AmEndBal(period; PV; FV; I%; PMT; N; P/Y; C/Y; B; round)

Returns the ending principal balance of the given period. This function is only available if p1 Finance Lib is installed. Same variables as above except:

- **P/Y:** payment periods per year. If not included, it is assumed to be 12.
- **C/Y:** interest compounding periods per year. If not included, it is assumed to be 12.
- **B:** payment timing (0 for end of period, 1 for beginning of period). If not included, it is assumed to be 0.
- **round:** decimal places to round the end balance to as it calculates. If not included, I is assumed to be 2.

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  AmEndBal(240; 150000; 0; 6; -899.325; 360; 12; 12; 0; 2) : returns 81,003.52

- RPN Input Mode

  240 [ENT] 150000 [ENT] 0 [ENT] 6 [ENT] –899.325 [ENT] 360 [ENT] 12 [ENT] 12 [ENT] 0 [ENT] 2 AmEndBal : returns 81,003.52

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4.2.6 Amortization, Interest Paid

AmSumInt(first; last; PV; FV; I%; PMT; N)

Returns the summation of interest paid given a range of periods. This function is only available if p1 Finance Lib is installed.

- **first:** calculate starting with this period.
- **last:** calculate ending with this period.
- **PV:** present value. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **FV:** future value. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **I%:** yearly interest rate expressed as a percentage.
- **PMT**: periodic payment amount. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **N:** total number of periods.

Category: finance

Input Modes: algebraic

Examples:

AmSumInt(1; 12; 150000; 0; 6; -899.325; 360) : returns –8,949.87

AmSumInt(first; last; PV; FV; I%; PMT; N; P/Y; C/Y; B; round)

Returns the summation of interest paid given a range of periods. This function is only available if p1 Finance Lib is installed. Same variables as above except:

- **P/Y:** payment periods per year. If not included, it is assumed to be 12.
- **C/Y:** interest compounding periods per year. If not included, it is assumed to be 12.
- **B:** payment timing (0 for end of period, 1 for beginning of period). If not included, it is assumed to be 0.
- **round:** decimal places to round the end balance to as it calculates. If not included, I is assumed to be 2.

Category: finance

Input Modes: algebraic

Examples:

- Algebraic Input Mode

  AmSumInt(1; 12; 150000; 0; 6; -899.325; 360; 12; 12; 0; 2) : returns –8,949.87

AmSumInt(first; last; PV; FV; I%; PMT; N; P/Y; C/Y; B; round; sign)

Returns the summation of interest paid given a range of periods. This function is only available if p1 Finance Lib is installed. Same variables as above except:

- **sign:** set to false to leave the sign of the answer in the outputted format. Set to true to swap the sign.

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  AmSumInt(1; 12; 150000; 0; 6; -899.325; 360; 12; 12; 0; 2; true) : returns 8,949.87

  AmSumInt(1; 12; 150000; 0; 6; -899.325; 360; 12; 12; 0; 2; false) : returns -8,949.87

- RPN Input Mode

  1 [ENT] 12 [ENT] 150000 [ENT] 0 [ENT] 6 [ENT] –899.325 [ENT] 360 [ENT] 12 [ENT] 12 [ENT] 0 [ENT] 2 [ENT]

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true AmSumInt : returns 8,949.87

1 [ENT] 12 [ENT] 150000 [ENT] 0 [ENT] 6 [ENT] –899.325 [ENT] 360 [ENT] 12 [ENT] 12 [ENT] 0 [ENT] 2 [ENT] false AmSumInt : returns -8,949.87

4.2.7 Amortization, Principal Paid

AmSumPrn(first; last; PV; FV; I%; PMT; N)

Returns the summation of principal paid given a range of periods. This function is only available if p1 Finance Lib is installed.

- **first:** calculate starting with this period.
- **last:** calculate ending with this period.
- **PV:** present value. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **FV:** future value. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **I%:** yearly interest rate expressed as a percentage.
- **PMT:** periodic payment amount. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **N:** total number of periods.

Category: finance

Input Modes: algebraic

Examples:

AmSumPrn(1; 12; 150000; 0; 6; -899.325; 360) : returns –1,842.09

AmSumPrn(first; last; PV; FV; I%; PMT; N; P/Y; C/Y; B; round)

Returns the summation of principal paid given a range of periods. This function is only available if p1 Finance Lib is installed. Same variables as above except:

- **P/Y:** payment periods per year. If not included, it is assumed to be 12.
- **C/Y:** interest compounding periods per year. If not included, it is assumed to be 12.
- **B:** payment timing (0 for end of period, 1 for beginning of period). If not included, it is assumed to be 0.
- **round:** decimal places to round the end balance to as it calculates. If not included, I is assumed to be 2.

Category: finance

Input Modes: algebraic

Examples:

- Algebraic Input Mode

  AmSumPrn(1; 12; 150000; 0; 6; -899.325; 360; 12; 12; 0; 2) : returns –1,842.09

AmSumPrn(first; last; PV; FV; I%; PMT; N; P/Y; C/Y; B; round; sign)

Returns the summation of principal paid given a range of periods. This function is only available if p1 Finance Lib is installed. Same variables as above except:

- **sign:** set to false to leave the sign of the answer in the outputted format. Set to true to swap the sign.

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

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AmSumPrn(1; 12; 150000; 0; 6; -899.325; 360; 12; 12; 0; 2; true) : returns 1,842.09

AmSumPrn(1; 12; 150000; 0; 6; -899.325; 360; 12; 12; 0; 2; false) : returns -1,842.09

- RPN Input Mode

  1 [ENT] 12 [ENT] 150000 [ENT] 0 [ENT] 6 [ENT] –899.325 [ENT] 360 [ENT] 12 [ENT] 12 [ENT] 0 [ENT] 2 [ENT] true AmSumPrn : returns 1,842.09

  1 [ENT] 12 [ENT] 150000 [ENT] 0 [ENT] 6 [ENT] –899.325 [ENT] 360 [ENT] 12 [ENT] 12 [ENT] 0 [ENT] 2 [ENT] false AmSumPrn : returns –1,842.09

4.2.8 And

valueA && valueB

Returns true if both valueA and valueB are true.

Data Types: boolean, table, matrix. Note: certain combinations do not work.

Category: bool

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  0 && 5 : returns false

  1 && 5 : returns true

  (5 > 3) && (5 < 3) : returns false

  (5 != 3) && (6 != 4) : returns true

- RPN Input Mode

  0 ENT 5 && : returns false

  1 ENT 5 && : returns true

  5 ENT 3 > 5 ENT 3 < && : returns false

  5 ENT 3 <> 6 ENT 4 <> && : returns true

valueA & valueB

Returns result of bitwise AND of valueA with valueB.

Data Types: integer, table, matrix. Note: certain combinations do not work.

Category: dev

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  110101_b & 1001_b : returns 1_d

  13_d & 105_d : returns 9_d

  [[1; 2]; [3; 4]] & [[5; 6]; [7; 8]] : returns [[1; 2]; [3; 0]] all in decimal base

- RPN Input Mode

  110101_b ENT 1001_b & : returns 1_d

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13_d ENT 105_d & : returns 9_d

[[1; 2]; [3; 4]] ENT [[5; 6]; [7; 8]] & : returns [[1; 2]; [3; 0]] all in decimal base

4.2.9 Angle

Angle is the same as theta. See Rectangular to Polar Conversion for more information.

4.2.10 Angle Symbol

@

Used to denote complex numbers in polar format. See the Types of Data : Complex Numbers section for additional information.

Category: cmplx

Input Modes: algebraic, RPN

4.2.11 Append

append(valueA; valueB)

Vertically concatenates two structures by adding additional rows provided they have the same number of columns. valueA and valueB must be the same data type.

Data Types: table, matrix

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  append({ {1; 2}; {3; 4} }; { {10; 11}; {12; 13} }) : returns { {1; 2}; {3; 4}; {10; 11}; {12; 13} }

- RPN Input Mode

  { {1; 2}; {3; 4} } ENT { {10; 11}; {12; 13} } append : returns { {1; 2}; {3; 4}; {10; 11}; {12; 13} }

4.2.12 Arc-Cosine

acos(value)

Returns arc-cosine of value.

Data Types: integer, floating point, complex, table, matrix. Note: certain combinations do not work.

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  acos(-.5) : returns 2.0944 when Trig Mode Preferences set to Radians

  acos(-.5) : returns 120 when Trig Mode Preferences set to Degrees

- Order of Operations and Chain Input Modes

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.5 +/- acos : returns 2.0944 when Trig Mode Preferences set to Radians

.5 +/- acos : returns 120 when Trig Mode Preferences set to Degrees

- RPN Input Mode

  .5 ENT +/- acos : returns 2.0944 when Trig Mode Preferences set to Radians

  .5 ENT +/- acos : returns 120 when Trig Mode Preferences set to Degrees

4.2.13 Arc-Sine

asin(value)

Returns arc-sine of value.

Data Types: integer, floating point, complex, table, matrix. Note: certain combinations do not work.

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  asin(.5) : returns 0.5236 when Trig Mode Preferences set to Radians

  asin(.5) : returns 30 when Trig Mode Preferences set to Degrees

- RPN, Order of Operations and Chain Input Modes

  .5 asin : returns 0.5236 when Trig Mode Preferences set to Radians

  .5 asin : returns 30 when Trig Mode Preferences set to Degrees

4.2.14 Arc-Tangent

atan(value)

Returns arc-tangent of value.

Data Types: integer, floating point, complex, table, matrix. Note: certain combinations do not work.

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  atan(1) : returns 0.7854 when Trig Mode Preferences set to Radians

  atan(1) : returns 45 when Trig Mode Preferences set to Degrees

- RPN, Order of Operations and Chain Input Modes

  1 atan : returns 0.7854 when Trig Mode Preferences set to Radians

  1 atan : returns 45 when Trig Mode Preferences set to Degrees

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4.2.15 Augment

augment(valueA; valueB)

Horizontally concatenates two structures by adding additional columns provided they have the same number of rows. valueA and valueB must be the same data type.

Data Types: table, matrix

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  augment([1; 2; 3]; [4; 5; 6]) : returns [[1; 4]; [2; 5]; [3; 6]]

- RPN Input Mode

  [1; 2; 3] ENT [4; 5; 6] augment : returns [[1; 4]; [2; 5]; [3; 6]]

4.2.16 Backspace

←

Moves backwards one space, deleting the item before the cursor (in algebraic and RPN input mode) or the last entered number in order of operations and chain input modes.

Category: not applicable

Input Modes: algebraic, RPN, order of operations, chain

Examples:

345.67 ← : shows 345.6

4.2.17 Binary

value_b

Designates that value is entered as a binary number.

Data Types: boolean, integer

Category: dev

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  1010_b : is equal to 10_d (decimal)

  1010_b + 12_ o : returns 10100_b

- RPN Input Mode

  1010_b ENT 12_ o + →b : returns 10100_b

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4.2.18 Binary, Display As

value →b

Displays value as a binary number.

Data Types: boolean, integer, floating point, table, matrix

Category: dev

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  15_h →b : returns 10101_b

  15_h + 12_d ®b : returns 100001_b

- RPN Input Mode

  10_d →b : returns 1010_b

  32_d ENT 12_d + ®b : returns 101100_b

4.2.19 Binomial Cumulative Distribution

BinomCDF(n; p)

Returns a list of floating point numbers containing the cumulative probability of 0 through n successes for the discrete binomial distribution with the specified trials and probability of success on each trial. This function is only available if p1 Stats Lib is installed.

- **n:** number of trials, must be an integer > 0
- **p:** probability of success, must be such that 0 <= p <= 1

Category: distr

Input Modes: algebraic

Examples:

BinomCDF(5; .9) : returns table {0.00001; 0.00046; 0.00856; 0.08146; 0.40951; 1}

BinomCDF(n; p; x)

Same as above except it returns the cumulative probability for the supplied value of x:

- **x:** a given data point, must be an integer >= 0 and <= n.

Category: distr

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  BinomCDF(5; 0.9; 3) : returns 0.0815

- RPN Input Mode

  5 ENT 0.9 ENT 3 BinomCDF : returns 0.0815

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4.2.20 Binomial Probability Distribution

BinomPDF(n; p)

Returns a list of floating point numbers containing the probability of observing successes x = 0 to n using a binomial method. This function is only available if p1 Stats Lib is installed.

- **n:** number of trials, must be an integer > 0
- **p:** probability of success, must be such that 0 <= p <= 1

Category: distr

Input Modes: algebraic

Examples:

BinomPDF(5; .9) : returns table {0.00001; 0.00045; 0.0081; 0.0729; 0.32805; .59049}

BinomPDF(n; p; x)

Same as above except that it returns the probability for the supplied value of x:

- **x:** a given data point, must be an integer >= 0 and <= n.

Category: distr

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  BinomPDF(5; 0.9; 3) : returns 0.0729

- RPN Input Mode

  5 ENT 0.9 ENT 3 BinomPDF : returns 0.0729

4.2.21 Bond Accrued Interest

BondA(SD; MD; C/Y; CR)

Returns the accumulated interest of a bond. This function is only available if p1 Finance Lib is installed.

- **SD:** settlement date entered in dd.mmyyyy format
- **MD:** maturity date entered in dd.mmyyyy format
- **CY:** number of compounding interest periods per year
- **CR:** coupon rate expressed as a percentage

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  BondA(1.012003; 15.122010; 4; 6) : returns 0.283

- RPN Input Mode

  1.012003 ENT 15.122010 ENT 4 ENT 6 BondA : returns 0.283

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4.2.22 Bond Price

BondP(SD; MD; C/Y; CR; RV; Y)

Returns the price of a bond. This function is only available if p1 Finance Lib is installed.

- **SD:** settlement date entered in dd.mmyyyy format
- **MD:** maturity date entered in dd.mmyyyy format
- **CY:** number of compounding interest periods per year
- **CR:** coupon rate expressed as a percentage
- **RV:** residual value
- **Y:** annual yield expressed as a percentage

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  BondP(1.012003; 31.122010; 4; 6; 100; 5.25) : returns 104.87

- RPN Input Mode

  1.012003 ENT 31.122010 ENT 4 ENT 6 ENT 100 ENT 5.25 BondP : returns 104.87

4.2.23 Bond Yield

BondY(SD; MD; C/Y; CR; RV; P)

Returns the yield of a bond expressed as a percentage. This function is only available if p1 Finance Lib is installed.

- **SD:** settlement date entered in dd.mmyyyy format
- **MD:** maturity date entered in dd.mmyyyy format
- **CY:** number of compounding interest periods per year
- **CR:** coupon rate expressed as a percentage
- **RV:** residual value
- **P:** price

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  BondY(1.012003; 31.122010; 4; 6; 100; 104) : returns 5.38

- RPN Input Mode

  1.012003 ENT 31.122010 ENT 4 ENT 6 ENT 100 ENT 104 BondY : returns 5.38

4.2.24 Boolean, Convert To

tobool(value)

Returns a boolean by converting value to a boolean value.

Data Types: boolean, integer, floating point, complex, table, matrix. Note: certain combinations do not work.

Category: number

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Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  tobool(0) : returns false (0)

  tobool(5 - 2) : returns true (1)

  tobool(5 / 2) : returns true (1)

  tobool(0) + tobool(5 - 2) + tobool(5 / 2) : returns 2

- RPN Input Mode

  0 toBool : returns false (0)

  5 ENT 2 - toBool : returns true (1)

  5 ENT 2 / : returns true (1)

  0 toBool 5 ENT 2 - toBool 5 ENT 2 + + : returns 2

4.2.25 Braces { }

{valueA; valueB;….} for a list

{ {valueA1; valueA2; ...}; {valueB1; valueB2;...} } for a table

Use braces to create a list or table. When creating a table, inside braces group rows.

Category: matrix, stats

Input Modes: algebraic, RPN

Examples:

{1; 2; 3} : returns list

1
2
3

{ {1}; {2}; {3} } : returns list

1	2	3

{ {1; 2}; {3; 4} } : returns table

1	2
3	4

4.2.26 Brackets [ ]

[valueA; valueB;….] for a vector

[[valueA1; valueA2;...]; [valueB1;valueB2;...]] for a matrix

Use brackets to create a vector or matrix. When creating a matrix, inside braces group rows.

Category: matrix

Input Modes: algebraic, RPN

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Examples:

[1; 2; 3] : returns vector

1
2
3

[[1]; [2]; [3]] : returns vector

1	2	3

[[1; 2]; [3; 4]] : returns matrix

1	2
3	4

4.3 C

This section covers functions beginning with the letter C.

4.3.1 Ceiling

ceil(value)

Returns the smallest integer greater than or equal to value.

Data Types: integer, floating point, complex, table, matrix

Category: number

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  ceil(4.5) : returns 5

  ceil(-4.5) : returns -4

  ceil({ {-15.2; 22}; {8.25; -89.9} }) : returns { {-15; 22}; {9; -89} }

  ceil((5; 1.4142)) : returns (5; 2)

- Order of Operations and Chain Input Modes

  4.5 ceil : returns 5

  4.5 +/- ceil : returns -4

- RPN Input Mode

  4.5 ceil : returns 5

  4.5 ENT +/- ceil : returns -4

  { {-15.2; 22}; {8.25; -89.9} } ceil : returns { {-15; 22}; {9; -89} }

  (5.1.4142) ceil : returns (5; 2)

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4.3.2 Chi-Squared Cumulative Distribution

chiCDF(lower; upper; df)

Returns the cumulative chi-squared distribution probability between lower and upper for the supplied degrees of freedom. This function is only available if p1 Stats Lib is installed.

- **lower:** lower boundary. Must be an integer or floating point number < upper and >= 0
- **upper:** upper boundary. Must be an integer or floating point number > lower
- **df:** degrees of freedom. Must be an integer > 0

Category: distr

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  chiCDF(0.5; 0.75; 10) : returns 3.8665e-5

- RPN Input Mode

  0.5 ENT 0.75 ENT 10 chiCDF : returns 3.8665e-5

4.3.3 Chi-Squared Probability Distribution

chiPDF(x; df)

Returns the probability density function (pdf) for the chi-squared distribution at a specified value for the supplied degrees of freedom. This function is only available if p1 Stats Lib is installed.

- **x:** point to analyze. Must be >= 0
- **df:** degrees of freedom. Must be an integer > 0

Category: distr

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  chiPDF(25; 10) : returns 1.8955e-3

- RPN Input Mode

  25 ENT 10 chiPDF : returns 1.8955e-3

4.3.4 Choose

choose(index; expression1; ...expressionN)

Uses index to pick one of the expressions following index then returns the value of the picked expression. index can be a number or an expression (as long as the expression can be evaluated), where 1 <= index <= number of expressions supplied.

Category: bool

Input Modes: algebraic (also available when creating templates)

Examples:

choose(3; 2; (3*5); 4; 5; "six"; 7) : returns 4

choose(2; 2; (3*5); 4; 5; "six"; 7) : returns 15

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choose((15/3); 2; (3*5); 4; 5; "six"; 7) : returns "six"

choose(A; 2; (3*5); 4; 5; "six"; 7) : returns 2 where A is a variable equal to 1

choose(3; 2; (3; @30); false) : returns false

choose(2; 2; (3; @30); false) : returns (3; @30) if the Trig Mode preference is Degrees or equivalent rectangular coordinates

4.3.5 Clear

CE/C

CE/C performs two different clear functions. If a number is currently being entered, selecting CE/C clears the current entry. If a mathematics symbol, equals or enter has been selected, clear clears the current calculation and, in the case of algebraic input mode, the history list (although it does not clear the calculation log).

Category: not applicable

Input Modes: algebraic, RPN, order of operations, chain

Clear

See Memory for additional information.

4.3.6 Colon-Equals

<macro name> := value

Assigns a value to a macro. See the Using the Calculator : Memory & Storage : My Data section for more information.

4.3.7 Column Norm

cNorm(matrix)

Returns the largest value of the sums of each column of the matrix or table.

Data Types: table, matrix

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  cNorm([[1; 2]; [3; 4]]) : returns 6

  cNorm({1; 2; 3}) : returns 6

- RPN Input Mode

  [[1; 2]; [3; 4]] cNorm : returns 6

  {1; 2; 3} cNorm : returns 6

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4.3.8 Combinations

nCr(n; r)

Returns the number of combinations of n taken r at a time. n, r must be integer values where r <= n, 0 <= n, r <= 170. Returned values correspond to n!/(r!(n-r)!)

Data Types: integer, floating point, table, matrix

Category: prob

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  nCr(8; 3) : returns 56

  nCr({10; 11; 12}; 2) : returns {45; 55; 66}

- Order of Operations and Chain Input Modes

  8 nCr 3 = : returns 56

- RPN Input Mode

  8 ENT 3 nCr : returns 56

  {10; 11; 12} ENT 2 nCr : returns {45; 55; 66}

4.3.9 Complex Number Constant

i

The complex number constant, which is equivalent to (0;1). Used to denote complex numbers in rectangular format. See the Types of Data : Complex Numbers section for additional information.

Category: cmplx

Input Modes: algebraic, RPN

4.3.10 Condition

cond(squarematrix)

Returns the matrix's condition from:
cnorm(squarematrix) * cnorm(squarematrix^{-1})
which indicates how well the matrix is likely to behave in matrix operations. The closer the condition to 1 the better behaved the matrix.

Data Types: matrix

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  cond([[1; 2]; [3; 4]]) : returns 21

  cond([[1; 0; 0; 0]; [0; 1; 0; 0]; [0; 0; 1; 0]; [0; 0; 0; 1]]) : returns 1

- RPN Input Mode

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[[1; 2]; [3; 4]] cond : returns 21

[[1; 0; 0; 0]; [0; 1; 0; 0]; [0; 0; 1; 0]; [0; 0; 0; 1]] cond : returns 1

4.3.11 Conjugate

conj(value)

Returns complex conjugate of a complex number or table of complex numbers.

Data Types: complex, table

Category: cmplx

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  conj((5; 1.4142)) : returns (5; -1.4142)

  conj({ {(1; 1.0); (2; 1.4142)}; {(3; 1.7321); (4; 2.0)} }) : returns { {(1; -1.0); (2; -1.4142)}; {(3; -1.7321); (4; -2.0)} }

- RPN Input Mode

  (5; 1.4142) conj : returns (5; -1.4142)

  { { (1; 1.0); (2; 1.4142) }; { (3; 1.7321); (4; 2.0) } } conj : returns { {(1; -1.0); (2; -1.4142)}; {(3; -1.7321); (4; -2.0)} }

4.3.12 Cosecant

csc(value)

Returns cosecant of value.

Data Types: integer, floating point, table, matrix

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  csc(0.5236) : returns 2 when Trig Mode Preferences set to Radians

  csc(30) : returns 2 when Trig Mode Preferences set to Degrees

- RPN, Order of Operations and Chain Input Modes

  0.5236 csc : returns 2 when Trig Mode Preferences set to Radians

  30 csc : returns 2 when Trig Mode Preferences set to Degrees

4.3.13 Cosine

cos(value)

Returns cosine of value.

Data Types: integer, floating point, complex, table, matrix

Category: trig

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Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  cos(30) : returns 0.1543 when Trig Mode Preferences set to Radians

  cos(30) : returns 0.866 when Trig Mode Preferences set to Degrees

- RPN, Order of Operations and Chain Input Modes

  30 cos : returns 0.1543 when Trig Mode Preferences set to Radians

  30 cos : returns 0.866 when Trig Mode Preferences set to Degrees

4.3.14 Cotangent

cot(value)

Returns cotangent of value.

Data Types: integer, floating point, table, matrix

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  cot(0.5236) : returns 1.7321 when Trig Mode Preferences set to Radians

  cot(30) : returns 1.7321 when Trig Mode Preferences set to Degrees

- RPN, Order of Operations and Chain Input Modes

  0.5236 cot : returns 1.7321 when Trig Mode Preferences set to Radians

  30 cot : returns 1.7321 when Trig Mode Preferences set to Degrees

4.3.15 Count

CfoCount(CFAmntList)

Returns the total number of periods in the given cash flow excluding the initial cash flow. This function is only available if p1 Finance Lib is installed.

- **CFAmntList:** list containing cash flow amounts where the first element is the initial cash flow.
- **CFFreqList:** list in which each element specifies the frequency of occurrence for a consecutive cash flow amount in CFList.

Category: finance

Input Modes: algebraic

Examples:

CfoCount({-5000; 4000; 3000; 3000}) : returns 3

CfoCount(CFAmntList; CFFreqList)

same as above

Category: finance

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Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  CfoCount({-5000; 4000; 3000}; {1; 1; 2}) : returns 3

  CfoCount({-5000; 4000; 3000}; {2; 1; 2}) : returns 4

- RPN Input Mode (HP48 Enter Mode Preference setting)

  {-5000; 4000; 3000} ENT {1; 1; 2} CfoCount : returns 3

See also Occurrences.

4.3.16 Cross Product

cross(vector1; vector2)

Returns a vector containing result of cross product between vector1 and vector2. The vectors must have the same dimensions. Does not work with matrices -- only vectors.

Data Types: vector

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  cross([1; 2; 3]; [4; 5; 6]) : returns [-3; 6; -3]

- RPN Input Mode

  [1; 2; 3] ENT [4; 5; 6] cross : returns [-3; 6; -3]

4.3.17 Cubed Root

cbrt(value)

Returns the cube root of value.

Data Types: integer, floating point, complex, table

Category: math

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  cbrt(5) : returns 1.71

  cbrt(87.6) : returns 4.4412

  cbrt((15; 1.4142)) : returns (2.4699;@0.0313) in radians

  cbrt({5; 6; 7}) : returns table {1.71; 1.8171; 1.9129}

- Order of Operations and Chain Input Modes

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5 $\sqrt[3]{x}$: 1.71

87.6 $\sqrt[3]{x}$: returns 4.4412

- RPN Input Mode

  5 $\sqrt[3]{x}$: returns 1.71

  87.6 $\sqrt[3]{x}$: returns 4.4412

  (15; 1.4142) $\sqrt[3]{x}$ returns (2.4699; @0.0313) in radians

  {5; 6; 7} $\sqrt[3]{x}$: returns {1.71; 1.8171; 1.9129}

4.3.18 Cumulative Standard Normal Distribution

normSDist(upperlimit)

Returns the area under the standard normal distribution curve (mean = 0, standard deviation = 1) bounded by an upper limit.

Data Types: integer, floating point, table, matrix

Category: distr

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  normSDist(0.5) : returns 0.6915

- RPN Input Mode

  0.5 ENT normSDist : returns 0.6915

4.3.19 Cumulative Sum

cumsum(value)

Returns a list of the cumulative sums of the elements in the list or columns of value, starting with the first element.

Data Types: table, matrix

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  cumsum({1; 2; 3}) : returns {1; 3; 6}

  cumsum([[1; 2]; [9; 8]]) : returns [[1; 2]; [10; 10]]

- RPN Input Mode

  {1; 2; 3} cumsum : returns {1; 3; 6}

  [[1; 2]; [9; 8]] cumsum : returns [[1; 2]; [10; 10]]

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4.4 D-F

This section covers functions beginning with the letters D through F.

4.4.1 Day of Week

wkday(date)

Returns a number representing the day of the week (1 = Sunday, 7 = Saturday). Date must be a date type or a value in dd.mmyyyy format.

Data Types: floating point, date, table, matrix

Category: date

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  wkday(today()) : returns today's weekday number (e.g, 6 for Friday)

  wkday(20.071969) : returns 1 (Sunday)

  choose(wkday(15.082003);"Sun";"Mon";"Tue";"Wed";Thu";"Fri";"Sat") : returns "Fri"

- RPN Input Mode with Preferences Decimal Settings set to 6.

  20.071969 wkday : returns 1 (Sunday)

4.4.2 Decimal

value _d

Designates that value is entered as an decimal number.

Data Types: boolean, integer

Category: dev

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  10_d : is equal to 10_d (decimal)

  15_d + 12_o : returns 25_d

- RPN Input Mode

  15_d ENT 12_o + →d : returns 25_d

4.4.3 Decimal Separator

. (decimal point)
, (decimal comma)

Separates the integer and fractional portion of the number. How numbers appear is set in the system preferences. See the device users manual for additional information.

Category: not applicable

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Input Modes: algebraic, RPN, order of operations, chain

4.4.4 Decimal, Display As

value →d

Displays value as a octal number.

Data Types: boolean, integer, floating point, table, matrix

Category: dev

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  15_h →d : returns 21_d

  32_d + 12_d →d : returns 44_d

- RPN Input Mode

  10_d →d : returns 10_d

  32_d ENT 12_d + →d : returns 44_d

4.4.5 Declining Balance Crossover Depreciation

DepDBSLBV (C; S; L; M; Y; R) (Book Value)
DepDBSLDA (C; S; L; M; Y; R) (Depreciation Amount)
DepDBSLDV (C; S; L; M; Y; R) (Depreciation Value)

Book value returns the book value (depreciable value + salvage value) for the asset at the end of the given year. Depreciation amount returns the amount that the asset depreciated during the given year. Depreciation value returns the remaining total depreciable value for the asset at the end of the given year. All three are calculated using the declining balance crossover to straight line method of depreciation. This function is only available if p1 Finance Lib is installed.

- **C:** cost of the depreciable asset
- **S:** salvage value of the depreciable asset
- **L:** life in years of the depreciable asset
- **M:** first month to begin depreciating (1 is January, 12 is December)
- **Y:** year to calculate
- **R:** depreciation rate expressed as a percentage

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  DepDBSLBV (150000; 20000; 20; 6; 3; 200) : returns 114,412.50

  DepDBSLDA (150000; 20000; 20; 6; 3; 200) : returns 12,712.50

  DepDBSLDV (150000; 20000; 20; 6; 3; 200) : returns 94,412.50

- RPN Input Mode (HP48 Enter Mode Preference setting)

  150000 ENT 20000 ENT 20 ENT 6 ENT 3 ENT 200 DepDBSLBV : returns 114,412.50

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150000 ENT 20000 ENT 20 ENT 6 ENT 3 ENT 200 DepDBSLDA : returns 12,712.50

150000 ENT 20000 ENT 20 ENT 6 ENT 3 ENT 200 DepDBSLDV : returns 94,412.50

4.4.6 Declining Balance Depreciation

DepDBBV (C; S; L; M; Y; R) (Book Value)
DepDBDA (C; S; L; M; Y; R) (Depreciation Amount)
DepDBDV (C; S; L; M; Y; R) (Depreciation Value)

Book value returns the book value (depreciable value + salvage value) for the asset at the end of the given year. Depreciation amount returns the amount that the asset depreciated during the given year. Depreciation value returns the remaining total depreciable value for the asset at the end of the given year. All three are calculated using the declining balance method of depreciation. This function is only available if p1 Finance Lib is installed.

- **C:** cost of the depreciable asset
- **S:** salvage value of the depreciable asset
- **L:** life in years of the depreciable asset
- **M:** first month to begin depreciating (1 is January, 12 is December)
- **Y:** year to calculate
- **R:** depreciation rate expressed as a percentage

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  DepDBBV (150000; 20000; 20; 6; 3; 200) : returns 114,412.50

  DepDBDA (150000; 20000; 20; 6; 3; 200) : returns 12,712.50

  DepDBDV (150000; 20000; 20; 6; 3; 200) : returns 94,412.50

- RPN Input Mode (HP48 Enter Mode Preference setting)

  150000 ENT 20000 ENT 20 ENT 6 ENT 3 ENT 200 DepDBBV : returns 114,412.50

  150000 ENT 20000 ENT 20 ENT 6 ENT 3 ENT 200 DepDBDA : returns 12,712.50

  150000 ENT 20000 ENT 20 ENT 6 ENT 3 ENT 200 DepDBDV : returns 94,412.50

4.4.7 Degrees to DMS Conversion

dms(value)

Returns equivalent in dd.mmss (degrees, minutes, seconds) of value degrees.

Data Types: integer, floating point, table, matrix

Category: number

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  dms(90.50) : returns 90.30

  dms({44.6333; 121.1333}) : returns {44.376; 121.076}

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- Order of Operations and Chain Input Modes

  90.50 dms : returns 90.30

- RPN Input Mode

  90.50 dms : returns 90.30

  {44.6333; 121.1333} dms : returns {44.376; 121.076}

4.4.8 Degrees to Radians Conversion

radians(value)

Returns equivalent in radians of value degrees.

Data Types: integer, floating point, table, matrix

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  radians(360) : returns 6.2832

- RPN, Order of Operations and Chain Input Modes

  360 radians : returns 6.2832

4.4.9 Derivative

nDeriv("expression"; "variable"; value)

Returns an approximate numerical derivative of expression with respect to variable at value. This function uses the "tolerance" constant.

- **expression:** the expression to analyze. Must be in quotations.
- **variable:** the variable within the expression. Must be in quotations.
- **value:** point to evaluate.

Category: calc

Input Modes: algebraic

Examples:

nDeriv("x^2"; "x"; 3) : returns 6

nDeriv("expression"; "variable"; value; e)

Same as above except with specified tolerance e.

- **e:** tolerance. If it is not included, it defaults to 10^{-4}.

Category: calc

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  nDeriv("x^2"; "x"; 3; 0.001) : returns 6

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- RPN Input Mode

  "x^2" ENT "x" ENT 3 ENT 0.001 nDeriv : returns 6

4.4.10 Derivative, Second

nDeriv2("expression"; "variable"; value)

Returns an approximate second numerical derivative of expression with respect to variable at value. This function uses the "tolerance" constant.

- **expression:** the expression to analyze. Must be in quotations.
- **variable:** the variable within the expression. Must be in quotations.
- **value:** point to evaluate.

Category: calc

Input Modes: algebraic

Examples:

nDeriv2("x^3"; "x"; 3) : returns 18

nDeriv2("expression"; "variable"; value; e)

Same as above except with specified tolerance e.

- **e:** tolerance. If it is not included, it defaults to 10^{-4}.

Category: calc

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  nDeriv2("x^2"; "x"; 3; 0.001) : returns 18

- RPN Input Mode

  "x^2" ENT "x" ENT 3 ENT 0.001 nDeriv : returns 6

4.4.11 Determinant

det(matrix)

Returns the determinant of the matrix.

Data Types: matrix

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  det(matrixA) : returns -2 where matrixA is [[1; 2]; [3; 4]]

  det([[5; 11]; [22; 28]]) : returns -102

- RPN Input Mode

  [[1; 2]; [3; 4]] det : returns –2

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[[5; 11]; [22; 28]] det : returns –102

4.4.12 Difference Between Dates

ddays(date1; date2)

date1, date2 must be a date type or a value in dd.mmyyyy format. Returns a value representing the number of days between two dates.

Data Types: floating point, date, table, matrix. Note: certain combinations do not work.

Category: date

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  ddays(01.082003;20.071969) : returns -12,430 in days.

- RPN Input Mode

  01.082003 ENT 20.071969 ddays : returns -12,430 in days.

4.4.13 Dimension

dim(structure)

Returns a list of integers containing the dimension of structure. If structure is a list or vector, an integer is returned (number of rows). If structure is a table or matrix, a list of integers is returned in {number of columns; number of rows} format.

Data Types: matrix, table

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  dim([[1; 2; 3]; [4; 5; 6]]) : returns {2; 3}

  dim({6; 7; 8; 9}) : returns 4

- RPN Input Mode

  [[1; 2; 3]; [4; 5; 6]] dim : returns {2; 3}

  {6; 7; 8; 9} dim : returns 4

4.4.14 Division

valueA / valueB

Returns valueA divided by valueB.

Data Types: integer, floating point, complex, table, matrix. Note: certain combinations do not work.

Category: not applicable

Input Modes: algebraic, RPN, order of operations, chain

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Examples:

- Algebraic Input Mode
  88 / 44 : returns 2
  18.6 / 4.5 : returns 4.1333
  (5; 1.4142) / 2 : returns (2.5; 0.7071)
  [[15; 22]; [38; 65]] / 4 : returns [[3.75; 5.5]; [9.5; 16.25]]
  {40; 20} / {6; 8} : returns {6.6667;2.5}
- Order of Operations and Chain Input Modes
  88 / 44 = : returns 2
  18.6 / 4.5 = : returns 4.1333
- RPN Input Mode
  88 ENT 44 / : returns 2
  18.6 ENT 4.5 / : returns 4.1333
  (5; 1.4142) ENT 2 / : returns (2.5; 0.7071)
  [[15; 22]; [38; 65]] ENT 4 / : returns [[3.75; 5.5]; [9.5; 16.25]]
  {40; 20} ENT {6; 8} / : returns {6.6667; 2.5}

4.4.15 DMS to Degrees Conversion

degs(value)

Returns equivalent in degrees of value dd.mmss (ie degrees, minutes, seconds format).

Data Types: integer, floating point, table, matrix

Category: number

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode
  degs(90.30) : returns 90.50
  degs({44.38; 121.08}) : returns {44.6333; 121.1333}
- Order of Operations and Chain Input Modes
  90.30 degs : returns 90.50
- RPN Input Mode
  90.30 degs : returns 90.50
  {44.38; 121.08} degs : returns {44.6333; 121.1333}

4.4.16 Dot Product

dot(vector1; vector2)

Returns result of the dot product between vector1 and vector2. The vectors must have the same dimensions.

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Data Types: vector

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  dot([1; 2; 3]; [4; 5; 6]) : returns 32

- RPN Input Mode

  [1; 2; 3] ENT [4; 5; 6] dot : returns 32

4.4.17 Effective Interest Rate

EffNom(rate; compoundingperiods)

Returns the effective interest rate. This function is only available if p1 Finance Lib is installed.

- **rate:** nominal annual interest rate. Must be an integer or floating point number.
- **compoundingperiods:** number of interest compounding periods per year. Must be an integer or floating point number greater than or equal to 0. 0 denotes continuous compounding.

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  IntEff(7; 360) : returns 7.250

  IntEff(7; 0) : returns 7.251

- RPN Input Mode

  7 ENT 360 IntEff : returns 7.250

4.4.18 Enter

ENT

Used to complete calculations in algebraic and RPN input modes. See the Using the Calculator : Input Modes section for more information.

4.4.19 Equals

valueA == valueB

Returns true if valueA is equal to value valueB. Note that this operator is entered using two consecutive "=" characters, not a single "=" character. The single "=" is only used when entering template equations.

Data Types: boolean, integer, floating point, date, complx, table, matrix. Note: certain combinations do not work.

Category: bool

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

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5 == 5 : returns true

5 == 1 - 5 : returns false

{ {1; 2}; {3; 4} } == { {1.1; 2}; {3; 4.8} } : returns { {false; true}; {true; false} }

- RPN Input Mode

  5 ENT 5 == : returns true

  5 ENT 1 - 5 == : returns false

  { {1; 2}; {3; 4} } ENT { {1.1; 2}; {3; 4.8} } == : returns { {false; true}; {true; false} }

=

Used to complete calculations in order of operations and chain input modes. See the Using the Calculator : Input Modes section for more information.

<variable name> = value

Assigns a value to a variable. See the Using the Calculator : Memory & Storage : My Data section for more information.

equation = equation

Used for creating solver equations. See the Templates : Creating Templates section for more information.

4.4.20 Exclusive Or

valueA ## valueB

Returns true if valueA is true or valueB is true but both are not true.

Data Types: boolean, table, matrix. Note: certain combinations do not work.

Category: bool

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  0 ## 1 : returns true

  1 ## 1 : returns false

  0 ## 0 : returns false

  (5>3) ## (5<3) : returns true

  (5>3) ## (5>4) : returns false

- RPN Input Mode

  0 ENT 1 ## : returns true

  1 ENT 1 ## : returns false

  0 ENT 0 ## : returns false

  5 ENT 3 > 5 ENT 3 < ## : returns true

  5 ENT 3 > 5 ENT 4 > ## : returns false

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valueA # valueB

Returns result of bitwise XOR of valueA with valueB.

Data Types: integer, table, matrix. Note: certain combinations do not work.

Category: dev

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  110101_b # 1001_b : returns 60_d

  13_d # 105_d : returns 100_d

  [[1; 2]; [3; 4]] & [[5; 6]; [7; 8]] : returns [[4; 4]; [4; 12] all in decimal base

- RPN Input Mode

  110101_b ENT 1001_b # : returns 60_d

  13_d ENT 105_d # : returns 100_d

  [[1; 2]; [3; 4]] ENT [[5; 6]; [7; 8]] # :returns [[4; 4]; [4; 12]] all in decimal base

4.4.21 Exponent

value E exponent

Used to make value times 10 raised to exponent where exponent is an integer (whole number). value*10exponent must lie between 1E-308 and 1E308 inclusive.

Data Types: integer, floating point, complex, table, matrix

Category: number

Input Modes: algebraic, RPN, order of operations, chain

Examples:

5E3 : equivalent to 5000

314 E +/- 2 = : equivalent to 3.14

4.4.22 Exponential

exp(value)

Returns e raised to the value power.

Data Types: integer, floating point, complex, table

Category: math

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  e ^ 4 : returns 54.5982

  e ^ 6.85 : returns 943.8809

  e ^ (4; 1.7321) : returns (-8.7687; 53.8894)

  e ^ {2; 3; 4} : returns {7.3891; 20.855; 54.5982}

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- Order of Operations and Chain Input Modes

  4 e^ : returns 54.5982

  6.85 e^ : returns 943.8809

- RPN Input Mode

  4 e^ : returns 54.5982

  6.85 e^ : returns 943.8809

  (4; 1.7321) e^ : returns (-8.7687; 53.8894)

  {2; 3; 4} e^ : returns {7.3891; 20.0855; 54.5982}

4.4.23 F Cumulative Distribution

fCDF(lower; upper; ndf; ddf)

Returns the probability that a random variable which follows an F distribution is between lower and upper for the specified degrees of freedom numerator and denominator. This function is only available if p1 Stats Lib is installed.

- **lower:** lower boundary. Must be an integer or floating point number < upper and >= 0
- **upper:** upper boundary. Must be an integer or floating point number > lower
- **ndf:** degrees of freedom numerator. Must be an integer > 0
- **ddf:** degrees of freedom denominator. Must be an integer > 0

Category: distr

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  fCDF(0.5; 0.75; 3; 4) : returns 0.1256

- RPN Input Mode

  0.5 ENT 0.75 ENT 3 ENT 4 fCDF : returns 0.1256

4.4.24 F Probability Distribution

fPDF(x; ndf; ddf)

Returns the probability density function (pdf) for the F distribution at a specified x value for the specified degrees of freedom numerator and denominator. This function is only available if p1 Stats Lib is installed.

- **x:** value to analyze. Must be an integer >= 0
- **ndf:** degrees of freedom numerator. Must be an integer > 0
- **ddf:** degrees of freedom denominator. Must be an integer > 0

Category: distr

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  fPDF(5; 2; 3) : returns 2.558e-2

- RPN Input Mode

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5 ENT 2 ENT 3 fPDF : returns 2.558e-2

4.4.25 Factorial

fact(value)

Returns factorial of value, where -169 < value <= 170.

Data Types: integer (positive numbers only), floating point, table, matrix

Category: prob

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  fact(6) : returns 720

  fact({1; 2; 3; 4; 5}) : returns {1; 2; 6; 24; 120}

- Order of Operations and Chain Input Modes

  6 ! : returns 720

- RPN Input Mode

  6 ! : returns 720

  {1; 2; 3; 4; 5} ! : returns {1; 2; 6; 24; 120}

4.4.26 Fill

fill(matrix; fillval)

Returns a matrix or table with the dimensions of struct filled with fillVal, which may be a boolean, integer, or float for matrices, plus complex, date or string for table.

Data Types: table, matrix

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  fill([[1; 2; 3]; [4; 5; 6]]; 16) : returns [[16; 16; 16]; [16; 16; 16]]

  fill({1; 2; 3; 4}; 4) : returns {4; 4; 4; 4}

- RPN Input Mode

  [[1; 2; 3]; [4; 5; 6]] ENT 16 fill : returns [[16; 16; 16]; [16; 16; 16]]

4.4.27 Floating Point, Convert To

tofloat(value)

Returns a floating point number by converting value.

Data Types: boolean, integer, floating point, table, matrix

Category: number

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Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  toFloat(5) : returns 5.0

- RPN Input Mode

  5 toFloat : returns 5.0

4.4.28 Floor

floor(value)

Returns the largest integer less than or equal to value.

Data Types: integer, floating point, complex, table, matrix

Category: number

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  floor(4.5) : returns 4

  floor(-4.5) : returns -5

  floor({ {-15.2; 22}; {8.25; -89.9} }) : returns { {-16; 22}; {8; -90} }

  floor((5; 1.4142)) : returns (5; 1)

- Order of Operations and Chain Input Modes

  4.5 floor : returns 4

  4.5 +/- floor : returns -5

- RPN Input Mode

  4.5 floor : returns 4

  4.5 ENT +/- floor : returns -5

  { {-15.2; 22}; {8.25; -89.9} } floor : returns { {-16; 22}; {8; -90} }

  (5; 1.4142) floor : returns (5; 1)

4.4.29 Fraction, Display As

value→frac

Returns value as a fraction.

Data Types: floating point

Category: number

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

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1.236→frac : returns (309/250)

0.5→frac : returns (1/2)

(1+3/4)→frac : returns (7/4)

- RPN Input Mode

  1.236 →frac : returns (309/250)

4.4.30 Fractional Part

fpart(value)

Returns fractional part of value.

Data Types: integer, floating point, complex, table, matrix

Category: number

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  fpart(5) : returns 0.0

  fpart(5.25) : returns .25

  fpart(5; 1.4142) : returns (0.0; 0.4142)

  fpart({ {1.56; 2.89}; {3.45; 4.73} }) : returns { {0.56; 0.89}; {0.45; 0.73} }

- Order of Operations and Chain Input Modes

  5 fPart : returns 0.0

  5.25 fPart : returns 0.25

- RPN Input Mode

  5 fPart : returns 0.0

  5.25 fPart : returns 0.25

  (5; 1.4142) fPart : returns (0.0; 0.4142)

  { {1.56; 2.89}; {3.45; 4.73} } fPart : returns { {0.56; 0.89}; {0.45; 0.73} }

4.4.31 Frobenius Norm

norm(matrix)

Returns the Frobenius norm of the matrix: sqrt(sum(real^2+imaginary^2))

Data Types: table, matrix

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  norm([[1; 2]; [3; 4]]) : returns 5.4772

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norm({1; 2; 3; 4; 5}) : returns 7.4162

- RPN Input Mode

  [[1; 2]; [3; 4]] norm : returns 5.4772

  {1; 2; 3; 4; 5} norm : returns 7.4162

4.4.32 Future Value

tvmfv(N; I%; PV; PMT)

Returns the future value of a time value of money (TVM) problem. Positive values mean a cash inflow while negative numbers mean a cash outflow. This function is only available if p1 Finance Lib is installed.

- **PV:** present value. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **PMT:** periodic payment amount. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **I%:** yearly interest rate expressed as a percentage
- **N:** total number of periods

Category: finance

Input Modes: algebraic

Examples:

tvmfv(600; 2.5; -10000; -200) : returns 273,495.59

tvmfv(N; I%; PV; PMT; P/Y; C/Y; B)

Returns the future value of a time value of money (TVM) problem. Positive values mean a cash inflow while negative numbers mean a cash outflow. This function is only available if p1 Finance Lib is installed. Same variables as above except

- **P/Y:** payment periods per year. If not included, it is assumed to be 12.
- **C/Y:** interest compounding periods per year. If not included, it is assumed to be 12.
- **B:** payment timing (0 for end of period, 1 for beginning of period). If not included, it is assumed to be 0.

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  tvmfv(600; 2.5; -10000; -200; 12; 12; 0) : returns 273,495.59

- RPN Input Mode

  600 ENT 2.5 ENT -10000 ENT -200 ENT 12 ENT 12 ENT 0 tvmfv : returns 273,495.59

4.5 G-H

This section covers functions beginning with the letters G through H.

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4.5.1 Geometric Cumulative Distribution

GeometCDF(p; x)

Returns a cumulative probability at x for the discrete geometric distribution with probability of success p, which is the probability that the first success occurs on or before the x^{th} trial. This function is only available if p1 Stats Lib is installed.

- **p:** probability of success. Must be an integer or floating point number >= 0 and <= 1.
- **x:** number of trials. Must be an integer >= 0.

Category: distr

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  GeometCDF(0.2; 10) : returns 0.8926

- RPN Input Mode

  0.2 ENT 10 GeometCDF : returns 0.8926

4.5.2 Geometric Probability Distribution

GeometPDF(p; x)

Returns the probability that the first success occurs on the x^{th} trial when the probability of success on each trial is p. This function is only available if p1 Stats Lib is installed.

- **p:** probability of success. Must be an integer or floating point number >= 0 and <= 1.
- **x:** first number. Must be an integer >= 0.

Category: distr

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  GeometPDF(0.2; 10) : returns 0.0268

- RPN Input Mode

  0.2 ENT 10 GeometPDF : returns 0.0268

4.5.3 Get Column

getCol(struct; col)

Returns a list (or vector) containing the elements of col in strurct.

- **struct:** the table or matrix to get the column from
- **col:** the column number to get

Data Types: matrix, table

Category: matrix

Input Modes: algebraic

Examples:

getCol({ {1; 2}; {3; 4} }; 1) : returns {1; 3}

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getCol(struct; col1; col2)

Returns a table (or matrix) containing the columns col1 through col2 from struct.

- **struct:** the table or matrix to get the rows from
- **col1:** the number of the first column to get
- **col2:** the number of the last column to get

Data Types: matrix, table

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  getCol([[1; 2; 3]; [4; 5; 6]; [7; 8; 9]]; 2; 3) : returns [[2; 3]; [5; 6]; [8; 9]]

- RPN Input Mode

  [[1; 2; 3]; [4; 5; 6]; [7; 8; 9]] ENT 2 ENT 3 getCol : returns [[2; 3]; [5; 6]; [8; 9]]

4.5.4 Get Date in Decimal Format

getdate(date)

Returns the date in dd.mmyyyy format given date type date.

Data Types: date, table

Category: date

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  getdate(today()) : returns today's date (e.g, 1.082003 if today's date of 08/01/03)

  getdate(adjDate(01.082003; -15) : returns 17.072003

- RPN Input Mode

  today getdate : returns 1.082003 if today's date of 08/01/03.

  01.082003 ENT 15 ENT +/- 0 ENT 0 adjDate getdate : returns 17.072003.

4.5.5 Get Hours in Decimal Format

hrs(value)

Returns the time in decimal hours given a date type or time in hh.mmssmmm format (3.5 decimal hours is 3 hrs, 30 min).

Data Types: integer, floating point, date, table, matrix

Category: date

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  hrs(today()) : returns the current time (e.g, 17:7989 given approximately 5:47 pm)

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hrs(10.4830) : returns 10.8083

- RPN Input Mode

  today hrs : returns 17:7989 given approximately 5:47 pm.

  10.4830 hrs : returns 10.8083

4.5.6 Get Hours in HH.MMSS Format

hms(value)

Returns the time in hh.mmssmmm format given a date type or the time in decimal hours (3.5 decimal hours is 3 hrs, 30 min).

Data Types: integer, floating point, date, table, matrix

Category: date

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  hms(10.8083) : returns 10.4830

- RPN Input Mode with Preferences Decimal Settings set to 4.

  10.8083 hms : returns 10.4830

4.5.7 Get Item

getItem(list; index)

Returns the element at position index from list.

Data Types: matrix, table

Category: matrix

Input Modes: algebraic

Examples:

getItem({6; 7; 8; 9}; 2) : returns 7

getItem(matrix; row; col)

Returns the element at column and row from matrix.

Data Types: matrix, table

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  getItem([[1; 2; 3]; [4; 5; 6]]; 2; 2) : returns 5

- RPN Input Mode

  [[1; 2; 3]; [4; 5; 6]] ENT 2 ENT 2 getItem : returns 5

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{6; 7; 8; 9} ENT 2 ENT 1 getItem : returns 7

4.5.8 Get Row

getRow(struct; row)

Returns a list (or vector) containing the elements of row in struct.

- **struct:** the table or matrix to get the row from
- **row:** the row number to get

Data Types: matrix, table

Category: matrix

Input Modes: algebraic

Examples:

getRow({6; 7; 8; 9}; 3) : returns {8}

getRow(struct; row1; row2)

Returns a table (or matrix) containing the rows row1 through row2 from struct.

- **struct:** the table or matrix to get the rows from
- **row1:** the number of the first row to get
- **row2:** the number of the last row to get

Data Types: matrix, table

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  getRow([[1; 2; 3]; [4; 5; 6]; [7; 8; 9]]; 2; 3) : returns [[4; 5; 6]; [7; 8; 9]]

- RPN Input Mode

  [[1; 2; 3]; [4; 5; 6]; [7; 8; 9]] ENT 2 ENT 3 getRow : returns [[4; 5; 6]; [7; 8; 9]]

  {6; 7; 8; 9} ENT 3 ENT 3 getRow : returns {8}

4.5.9 Get Time in Decimal Format

gettime(date)

This function can only be used within a formula – the returned value cannot be viewed in a template. Returns the time in the format hh.mmssmmm given date type date.

Data Types: date, table

Category: date

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  gettime(today()) : returns the current time (e.g, 18:0635 given 6:06:35 pm)

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- RPN Input Mode

  today gettime : returns the current time (e.g, 18:0635 given 6:06:35 pm)

4.5.10 Greater Than

valueA > valueB

Returns true if valueA greater than valueB.

Data Types: integer, floating point, date, table, matrix. Note: certain combinations do not work.

Category: bool

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  1 > 0.55 : returns true

  1 > 5 : returns false

  1 > 1 : returns false

  {1; 2; 3; 4} > 2.5 : returns {false; false; true; true}

- RPN Input Mode

  1 ENT 0.55 > : returns true

  1 ENT 5 > : returns false

  1 ENT 1 > : returns false

  {1; 2;3; 4} ENT 2.5 > : returns {false; false; true; true}

4.5.11 Greater Than or Equal To

valueA >= valueB

Returns true if valueA greater than or equal to valueB.

Data Types: integer, floating point, date, table, matrix. Note: certain combinations do not work.

Category: bool

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  1 >= 0.55 : returns true

  1 >= 5 : returns false

  1 >= 1 : returns true

  {1; 2; 3; 4} >= (2.5+.5) : returns {false; false; true; true}

- RPN Input Mode

  1 ENT 0.55 >= : returns true

  1 ENT 5 >= : returns false

  1 ENT 1 >= : returns true

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{1; 2; 3; 4} ENT 3 >= : returns {false; false; true; true}

4.5.12 Greatest Common Denominator

gcd(valueA; valueB)

Returns the greatest common integer divisor of valueA and valueB, where $-2^{31} <= valueA, valueB < 2^{31}$.

Data Types: integer, floating point, table, matrix. Note: certain combinations do not work.

Category: math

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  gcd(12; -63) : returns 3

  gcd({ {5}; {10} }; { {10}; {4} }) : returns { {5}; {2} }

- Order of Operations and Chain Input Modes

  12 gcd 63 +/- = : returns 3

- RPN Input Mode

  12 ENT 63 ENT +/- gcd : returns 3

  { {5}; {10} } ENT { {10}; {4} } gcd : returns { {5}; {2} }

4.5.13 Hexadecimal

value _h

Designates that value is entered as an hexadecimal number.

Data Types: boolean, integer

Category: dev

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  0A_h : is equal to 10_d (decimal)

  0E_h + 1101_b : returns 01B_h

- RPN Input Mode

  0E_h ENT 1101_b + →h : returns 01B_h

4.5.14 Hexadecimal, Display As

value →h

Displays value as a octal number.

Data Types: boolean, integer, floating point, table, matrix

Category: dev

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Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  10_d →h : returns 0A_h

  32_d + 12_d →h : returns 02C_h

- RPN Input Mode

  10_d →h : returns 0A_h

  32_d ENT 12_d + →h : returns 02C_h

4.5.15 History

history

Each time the equals button is selected, a new history item is stored. The software stores the last 10 recorded answers. To recall a value from the history list to the view window, select it.

Category: history

Input Modes: order of operations, chain

4.5.16 Hyperbolic Arc-Cosine

acosh(value)

Returns hyperbolic arc-cosine of value.

Data Types: integer, floating point, table, matrix

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  acosh(74.2099) : returns 5

- RPN, Order of Operations and Chain Input Modes

  74.2099 acosh : returns 5

4.5.17 Hyperbolic Arc-Sine

asinh(value)

Returns hyperbolic arc-sine of value.

Data Types: integer, floating point, table, matrix

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

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asinh(-1.1752) : returns -1

- Order of Operations and Chain Input Modes
  1.1752 +/- asinh : returns –1
- RPN Input Mode
  +/- 1.1752 asinh : returns –1

4.5.18 Hyperbolic Arc-Tangent

atanh(value)

Returns hyperbolic arc-tangent of value.

Data Types: integer, floating point, table, matrix

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode
  atanh(-0.7616) : returns -1
- RPN, Order of Operations and Chain Input Modes
  +/- 0.7616 atanh : returns –1

4.5.19 Hyperbolic Cosine

cosh(value)

Returns hyperbolic cosine of value.

Data Types: integer, floating point, complex, table, matrix

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode
  cosh(5) : returns 74.2099
- RPN, Order of Operations and Chain Input Modes
  5 cosh : returns 74.2099

4.5.20 Hyperbolic Sine

sinh(value)

Returns hyperbolic sine of value.

Data Types: integer, floating point, complex, table, matrix

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

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Examples:

- Algebraic Input Mode
  sinh(1) : returns 1.1752
- RPN, Order of Operations and Chain Input Modes
  1 sinh : returns 1.1752

4.5.21 Hyperbolic Tangent

tanh(value)

Returns hyperbolic tangent of value.

Data Types: integer, floating point, complex, table, matrix

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode
  tanh(1) : returns 0.7616
- RPN, Order of Operations and Chain Input Modes
  1 tanh : returns 0.7616

4.6 I-N

This section covers functions beginning with the letters I through N.

4.6.1 Identity

identity(dimension)

Returns the identity matrix of dimension rows x columns.

Data Types: matrix

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode
  identity(3) : returns [[1; 0; 0]; [0; 1; 0]; [0; 0; 1]]
- RPN Input Mode
  3 identity : returns [[1; 0; 0]; [0; 1; 0]; [0; 0; 1]]

4.6.2 If

if(boolean; expressionA; expressionB)

If boolean is true, evaluate expressionA, otherwise evaluate expressionB. See the Templates : Creating Templates

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section for more information.

Category: bool

Input Modes: algebraic (also available when creating templates)

Examples:

if(A > 0; 100/A; 0) : returns 100 divided by A if A is greater than 0 (true) or 0 if it is equal to or less than 0 (false)

4.6.3 Integer Part

iPart(value)

Returns integer (whole number) part of value.

Data Types: integer, floating point, complex, table, matrix

Category: number

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  ipart(5) : returns 5

  ipart(5.25) : returns 5

  ipart(5; 1.4142) : returns (5; 1)

  ipart({ {1.56; 2.89}; {3.45; 4.73}}) : returns { {1; 2}; {3; 4} }

- Order of Operations and Chain Input Modes

  5 iPart : returns 5

  5.25 iPart : returns 5

- RPN Input Mode

  5 iPart : returns 5

  5.25 iPart : returns 5

  (5; 1.4142) iPart : returns (5; 1)

  { {1.56; 2.89}; {3.45; 4.73} } iPart : returns { {1; 2}; {3; 4} }

4.6.4 Integer, Convert To

toInt(value)

Returns an integer by converting value to an integer between -4e9 and 4e9.

Data Types: boolean, integer, floating point, table, matrix.

Category: number

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  toInt(-5.1) : returns -5

- RPN Input Mode

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5.1 ENT +/- toInt : returns -5

4.6.5 Integral

fnInt ("expression"; "variable"; lower; upper)

Uses numerical integration (Gauss-Kronrod) to return the integral of expression with respect to variable, between lower and upper limits.

- **expression:** the expression to analyze. Must be in quotations.
- **variable:** the variable within the expression. Must be in quotations.
- **lower:** lower limit of the range to analyze
- **upper:** upper limit of the range to analyze

Category: calc

Input Modes: algebraic

Examples:

fnInt("x^2"; "x"; –3; 3) : returns 18

4.6.6 Interest Rate

tvmi(N; PV; PMT; FV)

Returns the yearly interest rate of a time value of money (TVM) problem. This function is only available if p1 Finance Lib is installed.

- **PV:** present value. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **FV:** future value. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **PMT:** periodic payment amount. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **N:** total number of periods

Category: finance

Input Modes: algebraic

Examples:

tvmi(120; -100000; 0; 150000) : returns 4.06

tvmi(N; PV; PMT; FV; P/Y; C/Y; B)

Returns the yearly interest rate of a time value of money (TVM) problem. This function is only available if p1 Finance Lib is installed. Same variables as above except

- **P/Y:** payment periods per year. If not included, it is assumed to be 12.
- **C/Y:** interest compounding periods per year. If not included, it is assumed to be 12.
- **B:** payment timing (0 for end of period, 1 for beginning of period). If not included, it is assumed to be 0.

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  tvmi(120; -100000; 0; 150000; 12; 12; 0) : returns 4.06

- RPN Input Mode

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120 ENT -100000 ENT 0 ENT 150000 ENT 12 ENT 12 ENT 0 tvmi : returns 4.06

4.6.7 Internal Rate of Return

CfoIRR(CFAmntList)

Returns the internal rate of return of the given cash flow. This function is only available if p1 Finance Lib is installed.

- **CFAmntList:** list containing cash flow amounts where the first element is the initial cash flow.
- **CFFreqList:** list in which each element specifies the frequency of occurrence for a consecutive cash flow amount in CFList.

Category: finance

Input Modes: algebraic

Examples:

CfoIRR({-5000; 4000; 3000; 3000}) : returns 47.96

CfoIRR(CFAmntList; CFFreqList)

same as above

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  CfoIRR({-5000; 4000; 3000}; {1; 1; 2}) : returns 47.96

- RPN Input Mode

  {-5000; 4000; 3000} ENT {1; 1; 2} CfoIRR : returns 47.96

4.6.8 Inverse

value ^ –1

Returns value raised to –1 power.

Data Types: integer, floating point, complex, table, matrix.

Category: matrix

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  4.2 ^ -1 : returns 0.2381

  { {1; 2}; {3; 4} } ^ -1 : returns { {1; 0.5}; {.3333; 0.25} }

  [[1; 2]; [3; 4]] ^ -1 : returns [[-2; 1]; [1.5; -0.5]]

  (5; 1.4142) ^ -1 : returns (0.1852; -0.0524)

- RPN Input Mode

  4.2 ^ -1 : returns 0.2381

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{ {1; 2}; {3; 4} } ^ -1 : returns { {1; 0.5}; {.3333; 0.25} }

[[1; 2]; [3; 4]] ^ -1 : returns [[-2; 1]; [1.5; -0.5]]

(5; 1.4142) ^ -1 : returns (0.1852; -0.0524)

4.6.9 Inverse Cumulative Normal Distribution

invNorm(prob)

Returns the value which would generate the given probability for the cumulative standard Normal distribution.

- **prob:** probability

Category: distr

Input Modes: algebraic

Examples:

invNorm(0.25) : returns -0.6745

invNorm(area; mean; stddev)

same as above except:

- **mean:** mean of the distribution. If not specified, mean is 0. If specified, must be an integer or floating point number.
- **stddev:** standard deviation of the distribution. If not specified, stddev is 1. If specified, must be an integer or floating point number.

Category: distr

Input Modes: algebraic

Examples:

- Algebraic Input Mode

  invNorm(0.25; 0.5; 1) : returns -0.1745

- RPN Input Mode

  0.25 ENT 0.5 ENT 1 invNorm : returns -0.1745

4.6.10 Last

last

In order of operations and chain input modes, returns the last entry recorded in the history list. In RPN input mode, returns the last item pushed on the stack. See History for more information.

Category: number

Input Modes: RPN, order of operations, chain

4.6.11 Least Common Multiple

lcm(valueA; valueB)

Returns the least common integer multiple of valueA and valueB, where $-2^{31} <= valueA, valueB < 2^{31}$.

Data Types: integer, floating point, table, matrix. Note: certain combinations do not work.

Category: math

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Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  lcm(12; -63) : returns 252

  lcm([[5]; [10]]; [[10]; [4]]) : returns [[10]; [20]]

- Order of Operations and Chain Input Modes

  12 lcm 63 +/- = : returns 252

- RPN Input Mode

  12 ENT 63 ENT +/- lcm : returns 252

  [[5]; [10]] ENT [[10]; [4]] lcm : returns [[10]; [20]]

4.6.12 Less Than

valueA < valueB

Returns true if valueA less than valueB.

Data Types: integer, floating point, date, table, matrix. Note: certain combinations do not work.

Category: bool

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  1 < 0.55 : returns false

  1 < 5 : returns true

  1 < 1 : returns false

  {1; 2; 3; 4} < 2.5 : returns {true; true; false; false}

- RPN Input Mode

  1 ENT 0.55 < : returns false

  1 ENT 5 < : returns true

  1 ENT 1 < : returns false

  {1; 2; 3; 4} ENT 2.5 < : returns {true; true; false; false}

4.6.13 Less Than or Equal To

valueA <= valueB

Returns true if valueA less than or equal to valueB.

Data Types: integer, floating point, date, table, matrix. Note: certain combinations do not work.

Category: bool

Input Modes: algebraic, RPN

Examples:

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- Algebraic Input Mode

  1 <= 0.55 : returns false

  1 <= 5 : returns true

  1 < =1 : returns false

  {1; 2; 3; 4} <= 2.5+.5 : returns {true; true; true; false}

- RPN Input Mode

  1 ENT 0.55 <= : returns false

  1 ENT 5 <= : returns true

  1 ENT 1 <= : returns false

  {1; 2; 3; 4} ENT 3 <= : returns {true; true; true; false}

4.6.14 Logarithm

log(value)

Returns the base 10 logarithm of value.

Data Types: integer, floating point, complex, table

Category: math

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  log(4) : returns 0.6021

  log(78.36) : returns 1.8941

  log((5; 1.4142)) : returns (0.7157; 0.1197)

  log({ {89; 53; 6}; {42; 76; 21} }) : returns { {1.9494; 1.7243; 0.7782}; {1.6232; 1.8808; 1.3222} }

- Order of Operations and Chain Input Modes

  4 log : returns 0.6021

  78.36 log : returns 1.8941

- RPN Input Mode

  4 log : returns 0.6021

  78.36 log : returns 1.8941

  (5; 1.4142) log : returns (0.7157; 0.1197)

  { {89; 53; 6}; {42; 76; 21} } log : returns { {1.9494; 1.7243; 0.7782}; {1.6232; 1.8808; 1.3222} }

4.6.15 Make Date from Decimal Format

makedate(dd.mmyyyy)

This function can only be used within a formula – the returned value cannot be viewed in a template. Converts a date into a date type representing the inputted date.

Data Types: integer, floating point

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Category: date

Input Modes: algebraic

Examples:

makedate(1.082003) : returns 8/1/03 12:00 am

makedate(dd.mmyyyy; hh.mmssmmm)

This function can only be used within a formula – the returned value cannot be viewed in a template. Converts a date and time into a date type representing the inputted date.

Data Types: integer, floating point

Category: date

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  makedate(20.071969; 22.5600) : returns 7/20/69 3:52 pm

- RPN Input Mode

  20.071969 ENT 22.5600 makedate : returns 7/20/69 10:56 pm

4.6.16 Matrix to Table Conversion

toTable(value)

Returns a table/list from a matrix/vector value.

Data Types: matrix

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  toTable([[1; 2]; [3; 4]]) : returns { {1; 2}; {3; 4} }

- RPN Input Mode

  [[1; 2]; [3; 4]] toTable : returns { {1; 2}; {3; 4} }

4.6.17 Maximum

max(valueA [; valueB; ...])

If given a series of values or a list, returns the largest value in the list. If given a series of lists of equal length, returns the largest value of each position within the list. [; valueB; ...] is optional. RPN input mode can only handle a single list.

Data Types: integer, floating point, date, table, matrix

Category: stats, matrix

Input Modes: algebraic, RPN

Examples:

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- Algebraic Input Mode

  max(2; 4; 6; 5; 3) : returns 6

  max({1; 2; 3; 4; 5}) : returns 5

  max({1; 2; 3; 4; 5}; {3; 6; 2; 1; 8}) : returns {3; 6; 3; 4; 8}

- RPN Input Mode

  {1; 2; 3; 4; 5} max : returns 5

  [[2; 4; 6]; [10; 8; 6]] max : returns 10

4.6.18 Maximum, Function

fMax("expression"; "variable"; lower; upper)

Uses an iterative method to determine the value of an independent variable for which the local maximum of an expression occurs. The possible values for the independent variable are limited to a range bracketed by the provided upper and lower limits. This function uses the "tolerance" constant.

- **expression:** the expression to analyze. Must be in quotations.
- **variable:** the independent variable within the expression. Must be in quotations.
- **lower:** lower limit of the range to analyze
- **upper:** upper limit of the range to analyze

Category: calc

Input Modes: algebraic

Examples:

- Algebraic Input Mode

  fMax("-x^2"; "x"; -3; 3) : returns -0.0001

fMax("expression"; "variable"; lower; upper ; e)

Same as above except:

- **e:** tolerance. This is optional. If it is not included, it defaults to 10^{-4}. Smaller values may lead to greater accuracy, but will cause the calculation to take longer to complete.

Category: calc

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  fMax("-x^2"; "x"; -3; 3; 0.5) : returns -0.0001

- RPN Input Mode

  "-x^2" ENT "x" ENT -3 ENT 3 fMax : returns -0.0001

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4.6.19 Mean

mean(datalist)

Returns the mean of a list or vector.

- **datalist:** a list containing values used in the calculation.

Data Types: table, matrix

Category: stats

Input Modes: algebraic

Examples:

mean({1; 2; 3; 4; 5}) : returns 3

mean(datalist; occlist)

Same as above except:

- **occlist:** a list, the same size as datalist, containing the number of occurrences of each corresponding value in datalist. Note that if occlist is not provided for functions that take occlist as an optional argument, the function treats each entry in datalist as a single occurrence.

Data Types: table, matrix

Category: stats

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  mean({1; 2; 3; 4; 5}; 1) : returns 3

  mean({1; 2; 3; 4; 5}; {2; 4; 4; 6; 6}) : returns 3.4545

- RPN Input Mode

  {1; 2; 3; 4; 5} ENT 1 mean : returns 3

  {1; 2; 3; 4; 5} ENT {2; 4; 4; 6; 6} mean : returns 3.4545

4.6.20 Median

median(datalist)

Returns the median of a list or vector.

- **datalist:** a list containing values used in the calculation.

Data Types: table, matrix

Category: stats

Input Modes: algebraic

Examples:

median({1; 2; 3; 4; 5}) : returns 3

median(datalist; occlist)

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Same as above except:

- **occlist:** a list, the same size as datalist, containing the number of occurrences of each corresponding value in datalist. Note that if occlist is not provided for functions that take occlist as an optional argument, the function treats each entry in datalist as a single occurrence.

Data Types: table, matrix

Category: stats

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  median({1; 2; 3; 4; 5}; 1) : returns 3

  median({1; 2; 3; 4; 5}; {2; 4; 4; 6; 6}) : returns 4

- RPN Input Mode

  {1; 2; 3; 4; 5} ENT 1 median : returns 3

  {1; 2; 3; 4; 5} ENT {2; 4; 4; 6; 6} median : returns 4

4.6.21 Memory

MEM

There are memory locations available for storing and recalling data. Often, these locations are grouped under MEM. Selecting MEM displays a list of functions:

- **STO/Store:** select to store an item to memory.
- **RCL/Recall:** select to recall an item from memory.
- **Clear:** select to clear the memory locations.

See the Using the Calculator : Memory & Storage : Memory Locations section for additional information.

Data Types: boolean, integer, floating point

Category: not applicable

Input Modes: algebraic, RPN, order of operations, chain

4.6.22 Minimum

min(valueA [; valueB; ...])

If given a series of values or a list, returns the smallest value in the list. If given a series of lists of equal length, returns the smallest value of each position within the list. [; valueB; ...] is optional. RPN input mode can only handle a single list.

Data Types: integer, floating point, date, table, matrix

Category: stats, matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  min(2; 4; 6; 5; 3) : returns 2

  min({1; 2; 3; 4; 5}) : returns 1

  min({1; 2; 3; 4; 5}; {3; 6; 2; 1; 8}) : returns {1; 2; 2; 1; 5}

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- RPN Input Mode

  {1; 2; 3; 4; 5} min : returns 1

  [[2; 4; 6]; [10; 8; 6]] min : returns 2

4.6.23 Minimum, Function

fMin("expression"; "variable"; lower; upper)

Uses an iterative method to determine the value of an independent variable for which the local minimum of an expression occurs. The possible values for the independent variable are limited to a range bracketed by the provided upper and lower limits. This function uses the "tolerance" constant.

- **expression:** the expression to analyze. Must be in quotations.
- **variable:** the independent variable within the expression. Must be in quotations.
- **lower:** lower limit of the range to analyze
- **upper:** upper limit of the range to analyze

Category: calc

Input Modes: algebraic

Examples:

fMin("x^2"; "x"; -3; 3) : returns -0.0001

fMin("expression"; "variable"; lower; upper ; e)

Same as above except:

- e: tolerance. This is optional. If it is not included, it defaults to 10^{-4}. Smaller values may lead to greater accuracy, but will cause the calculation to take longer to complete.

Category: calc

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  fMin("x^2"; "x"; -3; 3; 0.5) : returns -0.0001

- RPN Input Mode

  "x^2" ENT "x" ENT -3 ENT 3 fMin : returns -0.0001

4.6.24 Mixed Fraction, Display As

value→mFrac

Returns value as a mixed fraction.

Data Types: floating point

Category: number

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  1.236→mFrac : returns (1+ 59/250)

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0.5→mFrac : returns (1/2)

(7/4)→mFrac : returns (1+3/4)

- RPN Input Mode

  1.236 →mFrac : returns (1+ 59/250)

4.6.25 Modified Internal Rate of Return

CfoMIRR(I%; CFAmntList)

Returns the modified internal rate of return of the given cash flow. This function is only available if p1 Finance Lib is installed.

- **I%:** periodic interest rate as a percentage.
- **CFAmntList:** list containing cash flow amounts where the first element is the initial cash flow.
- **CFFreqList:** list in which each element specifies the frequency of occurrence for a consecutive cash flow amount in CFList.

Category: finance

Input Modes: algebraic

Examples:

CfoMIRR(12; {-5000; 4000; 3000; 3000}) : returns 31.53

CfoMIRR(I%; CFAmntList; CFFreqList)

same as above

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  CfoMIRR(12; {-5000; 4000; 3000}; {1; 1; 2}) : returns 31.53

- RPN Input Mode

  12 ENT {-5000; 4000; 3000} ENT {1; 1; 2} CfoMIRR : returns 31.53

4.6.26 Modulo Division

mod(valueA; valueB)

Returns remainder of valueA divided by valueB.

Data Types: integer, floating point, table, matrix. Note: certain combinations do not work.

Category: math

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  mod(5;2) : returns 1

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mod(6.8; 1.67) : returns 0.12

mod([[68; 42; 33]; [28; 99; 34]]; [[3; 7; 6]; [5; 22; 7]]) : returns [[2; 0; 3]; [3; 11; 6]]

- Order of Operations and Chain Input Modes

  5 mod 2 = : returns 1

  6.8 mod 1.67 = : returns 0.12

- RPN Input Mode

  5 ENT 2 mod : returns 1

  6.8 ENT 1.67 mod : returns 0.12

  [[68; 42;33]; [28; 99; 34]] ENT [[3; 7; 6]; [5; 22; 7]] mod : returns [[2; 0; 3]; [3; 11; 6]]

4.6.27 Multiplication

valueA * valueB

Returns valueA times valueB.

Data Types: integer, floating point, complex, table, matrix. Note: certain combinations do not work.

Category: not applicable

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  5 * 63 : returns 315

  8.2 * 32.65 : returns 267.73

  (5; 1.4142) * (45; 12.7278) : returns (207.0003; 127.2780)

  [[5; 4; 87]; [7; 3; 65]] * 6 : returns [[30; 24; 522]; [42; 18; 390]]

- Order of Operations and Chain Input Modes

  5 * 63 = : returns 315

  8.2 * 32.65 = : returns 267.73

- RPN Input Mode

  5 ENT 63 * : returns 315

  8.2 ENT 32.65 * : returns 267.73

  (5; 1.4142) ENT (45; 12.7278) * : returns (207.0003; 127.2780)

  [[5; 4; 87]; [7; 3; 65]] ENT 6 * : returns [[30; 24; 522]; [42; 18; 390]]

4.6.28 Natural Logarithm

ln(value)

Returns the natural logarithm of value.

Data Types: integer, floating point, complex, table

Category: math

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Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  ln(4) : returns 1.3863

  ln(52.43) : returns 3.9595

  ln((5; 1.4142)) : returns (1.6479; 0.2756)

  ln({54; 92; 88}) : returns {3.9890; 4.5218; 4.4773}

- Order of Operations and Chain Input Modes

  4 ln : returns 1.3863

  52.43 ln : returns 3.9595

- RPN Input Mode

  4 ln : returns 1.3863

  52.43 ln : returns 3.9595

  (5;1.4142) ln : returns (1.6479; 0.2756)

  {54; 92; 88} ln : returns {3.9890; 4.5218; 4.4773}

4.6.29 Net Future Value

CfoNFV(I%; CFAmntList)

Returns the net future value of the given cash flow. This function is only available if p1 Finance Lib is installed.

- **I%:** periodic interest rate as a percentage.
- **CFAmntList:** list containing cash flow amounts where the first element is the initial cash flow.
- **CFFreqList:** list in which each element specifies the frequency of occurrence for a consecutive cash flow amount in CFList.

Category: finance

Input Modes: algebraic

Examples:

CfoNFV(12; {-5000; 4000; 3000; 3000}) : returns 4,352.96

CfoNFV(I%; CFAmntList; CFFreqList)

same as above

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  CfoNFV(12; {-5000; 4000; 3000}; {1; 1; 2}) : returns 4,352.96

- RPN Input Mode

  12 ENT {-5000; 4000; 3000} ENT {1; 1; 2} CfoNFV : returns 4,352.96

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4.6.30 Net Present Value

CfoNPV(I%; CFAmntList)

Returns the net present value of the given cash flow. This function is only available if p1 Finance Lib is installed.

- **I%:** periodic interest rate as a percentage.
- **CFAmntList:** list containing cash flow amounts where the first element is the initial cash flow.
- **CFFreqList:** list in which each element specifies the frequency of occurrence for a consecutive cash flow amount in CFList.

Category: finance

Input Modes: algebraic

Examples:

CfoNPV(12; {-5000; 4000; 3000; 3000}) : returns 3,098.35

CfoNPV(I%; CFAmntList; CFFreqList)

same as above

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  CfoNPV(12; {-5000; 4000; 3000}; {1; 1; 2}) : returns 3,098.35

- RPN Input Mode

  12 ENT {-5000; 4000; 3000} ENT {1; 1; 2} CfoNPV : returns 3,098.35

4.6.31 Net Uniform Series

CfoNUS(I%; CFAmntList)

Returns the net uniform series of the given cash flow. This function is only available if p1 Finance Lib is installed.

- **I%:** periodic interest rate as a percentage.
- **CFAmntList:** list containing cash flow amounts where the first element is the initial cash flow.

Category: finance

Input Modes: algebraic

Examples:

CfoNUS(12; {-5000; 4000; 3000; 3000}) : returns 1,290.00

CfoNUS(I%; CFAmntList; CFFreqList)

Returns the net uniform series of the given cash flow. This function is only available if p1 Finance Lib is installed. Same variables as above except:

- **CFFreqList:** list in which each element specifies the frequency of occurrence for a consecutive cash flow amount in CFList.

Category: finance

Input Modes: algebraic

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Examples:

CfoNUS(12; {-5000; 4000; 3000}; {1; 1; 2}) : returns 1,290.00

CfoNUS(I%; CFAmntList; B)

Returns the net uniform series of the given cash flow. This function is only available if p1 Finance Lib is installed. Same variables as above except:

- **B:** payment timing (0 for end of period, 1 for beginning of period). If not included, it is assumed to be 0.

Category: finance

Input Modes: algebraic

Examples:

CfoNUS(12; {-5000; 4000; 3000}; 0) : returns 569.81

CfoNUS(12; {-5000; 4000; 3000}; 1) : returns 508.76

CfoNUS(I%; CFAmntList; CFFreqList; B)

Returns the net uniform series of the given cash flow. This function is only available if p1 Finance Lib is installed. Same variables as above.

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  CfoNUS(12; {-5000; 4000; 3000}; {1; 1; 2}; 0) : returns 1,290.00

  CfoNUS(12; {-5000; 4000; 3000}; {1; 1; 2}; 1) : returns 1,151.78

- RPN Input Mode

  12 [ENT] {-5000; 4000; 3000} [ENT] {1; 1; 2} [ENT] 0 CfoNUS : returns 1,290.00

  12 [ENT] {-5000; 4000; 3000} [ENT] {1; 1; 2} [ENT] 1 CfoNUS : returns 1,151.78

4.6.32 Nominal Interest Rate

IntNom(rate; compoundingperiods)

Returns the nominal interest rate. This function is only available if p1 Finance Lib is installed.

- **rate:** effective annual interest rate. Must be an integer or floating point number.
- **compoundingperiods:** number of interest compounding periods per year. Must be an integer or floating point number greater than or equal to 0. 0 denotes continuous compounding.

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  IntNom(7; 360) : returns 6.767

  IntNom(7; 0) : returns 6.766

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- RPN Input Mode

  7 ENT 360 IntNom : returns 6.767

4.6.33 Normal Cumulative Distribution

NormalCDF(lower; upper)

Returns the standard Normal cumulative distribution probability between the supplied lower and upper bounds. This function is only available if p1 Stats Lib is installed.

- **lower:** lower boundary. Must be an integer or floating point number less than upper
- **upper:** upper boundary. Must be an integer or floating point number greater than lower

Category: distr

Input Modes: algebraic

Examples:

NormalCDF(5; 15) : returns 2.871e-7

NormalCDF(lower; upper; mean; stddev)

Same as above except

- **mean:** mean of the distribution. If not specified, mean is 0. If specified, must be an integer or floating point number.
- **stddev:** standard deviation of the distribution. If not specified, stddev is 1. If specified, must be an integer or floating point number greater than 0.

Category: distr

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  NormalCDF(5; 15; 3.5; 2) : returns 0.2266

- RPN Input Mode

  5 ENT 15 ENT 3.5 ENT 2 NormalCDF : returns 0.2266

4.6.34 Normal Probability Distribution

NormalPDF(x)

Returns the value of the probability density function for the standard Normal distribution at the specified x value. This function is only available if p1 Stats Lib is installed.

- **x:** the value to evaluate

Category: distr

Input Modes: algebraic

Examples:

NormalPDF(0.025) : returns 0.3988

NormalPDF(x; mean; stddev)

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Same as above except

- **mean:** mean of the distribution. If not specified, mean is 0. If specified, must be an integer or floating point number.
- **stddev:** standard deviation of the distribution. If not specified, stddev is 1. If specified, must be an integer or floating point number greater than 0.

Category: distr

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  NormalPDF(0.025; 3.5; 2) : returns 4.4089e-2

- RPN Input Mode

  5 ENT 15 ENT 3.5 ENT 2 NormalPDF : returns 4.4089e-2

4.6.35 Not

! valueA

Returns false if valueA is true and returns true if value is false.

Data Types: integer, floating point, table, matrix

Category: bool

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  ! (4+1 == 5) : returns false

  ! (6 < 5) : returns true

- RPN Input Mode

  4 ENT 1 + 5 ! : returns false

  6 ENT 5 < ! : returns true

~valueA

Returns result of bitwise NOT (one's complement) of valueA.

Data Types: integer, table, matrix.

Category: dev

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  ~110101_b : returns 1111111111001010_b

  ~13_d : returns -14_d

  ~[[5; 6]; [7; 8]] : returns [[-6; -7]; [-8; -9] all in decimal base

- RPN Input Mode

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110101_b ~ ->b : returns 1111111111001010_b

13_d ~ : returns -14_d

[[5; 6]; [7; 8]] ~ : returns [[-6; -7]; [-8; -9]] all in decimal base

4.6.36 Not Equal

valueA <> valueB
valueA != valueB

Returns true if valueA does not equal valueB.

Data Types: boolean, integer, floating point, date, complex, table, matrix. Note: certain combinations do not work.

Category: bool

Input Modes: algebraic, RPN

Examples:

5 != 6 : returns true

(5*3) != 15 : returns false

4.7 O-Q

This section covers functions beginning with the letters O through Q.

4.7.1 Occurrences

countx(datalist)

Returns the total number of data points contained in a list.

- **datalist:** a list containing values used in the calculation.

Data Types: table, matrix

Category: stats

Input Modes: algebraic

Examples:

countx({1; 2; 3; 4; 5}) : returns 5

countx(datalist ; occlist)

Same as above except:

- **occlist:** a list, the same size as datalist, containing the number of occurrences of each corresponding value in datalist. Note that if occlist is not provided for functions that take occlist as an optional argument, the function treats each entry in datalist as a single occurrence.

Data Types: table, matrix

Category: stats

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

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countx({1; 2; 3; 4; 5}; 1) : returns 22

countx({1; 2; 3; 4; 5}; {2; 4; 4; 6; 6}) : returns 22

- RPN Input Mode

  {1; 2; 3; 4; 5} ENT 1 countx : returns 5

  {1; 2; 3; 4; 5} ENT {2; 4; 4; 6; 6} countx : returns 22

4.7.2 Octal

value _o

Designates that value is entered as an octal number.

Data Types: boolean, integer

Category: dev

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  12_o : is equal to 10_d (decimal)

  7_o + 7_d : returns 16_o

- RPN Input Mode

  7_o ENT 7_d + →o : returns 16_o

4.7.3 Octal, Display As

value →o

Displays value as a octal number.

Data Types: boolean, integer, floating point, table, matrix

Category: dev

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  10_d →o : returns 12_o

  32_d + 12_d →o : returns 54_o

- RPN Input Mode

  10_d →o : returns 12_o

  32_d ENT 12_d + →o : returns 54_o

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4.7.4 Or

valueA || valueB

Returns true if valueA is true or valueB is true.

Data Types: boolean, table, matrix

Category: bool

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  (5 == 5) || (4 > 5) : returns true

  (5 != 5) || (4 > 5) : returns false

- RPN Input Mode

  5 ENT 5 == 4 ENT 5 > || : returns true

  5 ENT 5 <> 4 ENT 5 > || : returns false

valueA | valueB

Returns result of bitwise OR of valueA with valueB.

Data Types: integer, table, matrix.

Category: dev

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  110101_b | 1001_b : returns 61_d

  13_d | 105_d : returns 109_d

  [[1; 2]; [3; 4]] | [[5; 6]; [7; 8]] : returns [[5; 6]; [7; 12]] all in decimal base

- RPN Input Mode

  110101_b ENT 1001_b | : returns 61_d

  13_d ENT 105_d | : returns 109_d

  [[1; 2]; [3; 4]] ENT [[5; 6]; [7; 8]] | : returns [[5;6];[7;12]] all in decimal base

4.7.5 Parentheses

parentheses ( )

Use parentheses to establish precedence when performing calculations. Items within parentheses are evaluated first.

Category: number

Input Modes: algebraic, order of operations, chain

Examples:

3 + (4 * 5) : returns 23

(3 + 4) * 5 : returns 35

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4.7.6 Payback

CfoPbk(CFAmntList)

Returns the period number when the initial investment of a given cash flow will be paid back. This function is only available if p1 Finance Lib is installed.

- **CFAmntList:** list containing cash flow amounts where the first element is the initial cash flow.
- **CFFreqList:** list in which each element specifies the frequency of occurrence for a consecutive cash flow amount in CFList.

Category: finance

Input Modes: algebraic

Examples:

CfoPbk({-5000; 4000; 3000; 3000}) : returns 1.33

CfoPbk(CFAmntList; CFFreqList)

same as above

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  CfoPbk({-5000; 4000; 3000}; {1; 1; 2}) : returns 1.33

- RPN Input Mode

  {-5000; 4000; 3000} ENT {1; 1; 2} CfoPbk : returns 1.33

4.7.7 Payment

tvmpmt(N; I%; PV; FV)

Returns the periodic payment amount of a time value of money (TVM) problem. Positive values mean a cash inflow while negative numbers mean a cash outflow. This function is only available if p1 Finance Lib is installed.

- **PV:** present value. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **FV:** future value. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **I%:** yearly interest rate expressed as a percentage
- **N:** total number of periods

Category: finance

Input Modes: algebraic

Examples:

tvmpmt(360; 7.5; 200000; 0) : returns -1,398.43

tvmpmt(N; I%; PV; FV; P/Y; C/Y; B)

Returns the periodic payment amount of a time value of money (TVM) problem. Positive values mean a cash inflow while negative numbers mean a cash outflow. This function is only available if p1 Finance Lib is installed. Same variables as above except

- **P/Y:** payment periods per year. If not included, it is assumed to be 12.

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- **C/Y:** interest compounding periods per year. If not included, it is assumed to be 12.
- **B:** payment timing (0 for end of period, 1 for beginning of period). If not included, it is assumed to be 0.

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  tvmpmt(360; 7.5; 200000; 0; 12; 12; 0) : returns -1,398.43

- RPN Input Mode

  360 ENT 7.5 ENT 200000 ENT 0 ENT 12 ENT 12 ENT 0 tvmpmt : returns -1,398.43

4.7.8 Percent

value%

In general, valueA% returns the equvalent of valueA / 100. When it is preceded by a value and a math operand, the following occurs in each case:

value% : value / 100
valueA + valueB% : valueA + (valueA * (valueB / 100))
valueA – valueB% : valueA – (valueA * (valueB / 100))
valueA * valueB% : value A * (valueB / 100)
valueA / valueB% : valueA / (valueB / 100)

Data Types: integer, floating point, complex, table, matrix.

Category: math

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  42 % : returns 0.42

  80 + 10 % : returns 88 (80 + 10% of 80)

  80 - 10 % : returns 72 (80 - 10% of 80)

  522 * 63 % : returns 328.86

  24 / 33 % : returns 72.7273

  [[56.24; 22.76]; [43.00; 23.42]] + 25 % : returns [[70.30; 28.45]; [53.75; 29.28]]

- Order of Operations and Chain Input Modes

  42 % :returns 0.42

  80 + 10 % : returns 88

  80 - 10 % : returns 72

  522 * 63 % = : returns 328.86

  24 / 33 % = : returns 72.7273

- RPN Input Mode

  42 % : returns 0.42

  522 ENT 63 % : returns 328.86

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24 ENT .33 / : returns 72.7273

[[56.24; 22.76]; [43.00; 23.42]] ENT 25 % + : returns [[70.30; 28.45]; [53.75; 29.28]]

4.7.9 Periods

tvmn(I%; PV; PMT; FV)

Returns the total number of periods of a time value of money (TVM) problem. This function is only available if p1 Finance Lib is installed.

- **PV:** present value. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **FV:** future value. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **PMT:** payment amount. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **I%:** interest rate expressed as a percentage

Category: finance

Input Modes: algebraic

Examples:

tvmn(7.25; 35000; -3000; 0) : returns 12.13

tvmn(I%; PV; PMT; FV; P/Y; C/Y; B)

Returns the total number of periods of a time value of money (TVM) problem. This function is only available if p1 Finance Lib is installed. Same variables as above except

- **P/Y:** payment periods per year. If not included, it is assumed to be 12.
- **C/Y:** interest compounding periods per year. If not included, it is assumed to be 12.
- **B:** payment timing (0 for end of period, 1 for beginning of period). If not included, it is assumed to be 0.

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  tvmn(7.25; 35000; -3000; 0; 12; 12; 0) : returns 12.13

- RPN Input Mode

  7.25 ENT 35000 ENT -3000 ENT 0 ENT 12 ENT 12 ENT 0 tvmn : returns 12.13

4.7.10 Permutations

nPr(n; r)

Returns the number of permutations of n taken r at a time. n, r must be integer values where r <= n, 0 <= n, r <= 170. Returned values correspond to n!/(n-r)!

Data Types: integer, floating point, table, matrix

Category: prob

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

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nPr(8;3) returns 336

nPr({10; 11; 12}; 2) returns {90; 110; 132}

- Order of Operations and Chain Input Modes

  8 nPr 3 = : returns 336

- RPN Input Mode

  8 nPr 3 nPr : returns 336

  {10; 11; 12} ENT 2 nPr : returns {90; 110; 132}

4.7.11 Poisson Cumulative Distribution

PoissonCDF(mean; x)

Returns the cumulative probability at x for the discrete Poisson distribution with specified mean. This function is only available if p1 Stats Lib is installed.

- **mean:** mean of the distribution. Must be an integer or floating point number > 0.
- **x:** must be an integer >= 0.

Category: distr

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  PoissonCDF(3.5; 2) : returns 0.3208

- RPN Input Mode

  3.5 ENT 2 PoissonCDF : returns 0.3208

4.7.12 Poisson Probability Distribution

PoissonPDF(mean; x)

Returns the probability at x for the discrete Poisson distribution with specified mean. This function is only available if p1 Stats Lib is installed.

- **mean:** mean of the distribution. Must be an integer or floating point number > 0.
- **x:** must be an integer >= 0.

Category: distr

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  PoissonPDF(3.5; 2) : returns 0.1850

- RPN Input Mode

  3.5 ENT 2 PoissonPDF : returns 0.1850

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4.7.13 Polar to Rectangular Conversion

imag(r; q)

Returns y coordinate given polar coordinates r and q.

Data Types: integer, floating point, table, matrix

Category: cmplx

Input Modes: algebraic

Examples:

- Trig Mode preference set to Radians

  imag(5; 4) : returns –3.7840 when Trig Mode set to radians

  imag([[3; 4]; [5; 6]]; [1; 2]; [7; 8]]) : returns [[2.5244; 3.6372]; [3.2849; 5.9361]] when Trig Mode set to radians

imag(valueA)

Returns imaginary part of a complex number.

Data Types: complex

Category: cmplx

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  imag((5; 1.4142)) : returns 1.4142

- RPN Input Mode

  (5; 1.4142) imag : returns 1.4142

real(r; q)

Returns the x coordinate given polar coordinates r and q.

Data Types: integer, floating point, table, matrix

Category: cmplx

Input Modes: algebraic

Examples:

real(5; 4) : returns –3.2682 when Trig Mode set to radians

real([[3; 4]; [5; 6]]; [1; 2]; [7; 8]]) : returns [[1.6209; -1.6646]; [3.7695; -0.8730]] when Trig Mode set to radians

real(valueA)

Returns real part of a complex number.

Data Types: complex

Category: cmplx

Input Modes: algebraic, RPN

Examples:

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- Algebraic Input Mode

  real((5; 1.4142)) : returns 5

- RPN Input Mode

  (5; 1.4142) real : returns 5

4.7.14 Polar, Convert To

toPolar(value)

Returns a complex number in polar format from value.

Data Types: boolean, integer, floating point, complex, table, matrix

Category: cmplx

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  toPolar(15.5) : returns (15.5; @0.0)

  toPolar((25; @30)) : returns (25; @-1.4159265)

  toPolar([[1; 2]; [3; 4]]) : returns [[(1.0; @0.0); (2.0; @0.0)]; [(3.0; @0.0); (4.0; @0.0)]]

- RPN Input Mode

  15.5 toPolar : returns (15.5; @0.0)

  [[1; 2]; [3; 4]] toPolar : returns [[(1.0; @0.0); (2.0; @0.0)]; [(3.0; @0.0); (4.0; @0.0)]]

4.7.15 Poly

poly(a; b [;c...])

Returns a list with the real and complex roots of a polynomial expression.

Category: math

Input Modes: algebraic, RPN

Examples:

$x^3 - 2x^2 - 5x + 6 = 0$

- Algebraic Input Mode

  poly(1; -2; -5; 6) : returns {-2; 1; 3}

- RPN Input Mode

  1 ENT -2 ENT -5 ENT 6 poly : returns {-2 ; 1; 3}

4.7.16 Power

valueA ^ valueB

Returns valueA raised to valueB.

Data Types: integer, floating point, complex, table, matrix. Note: certain combinations do not work.

Category: math

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Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  3 ^ 3 : returns 27

  3 ^ -2.2 : returns .0892

  {5; 6; 7} ^ {1; 2; 3} : returns {5; 36; 343}

  [[4; 5]; [7; 8]] ^ 4 : returns [[7,641; 9,000]; [12,600; 14,841]]

- Order of Operations and Chain Input Modes

  3 ^ 3 = : returns 27

  3 ^ 2.2 +/- = : returns .0892

- RPN Input Mode

  3 ENT 3 ^ : returns 27

  3 ENT 2.2 ENT +/- ^ : returns .0892

  {5; 6; 7} ENT {1; 2; 3} ^ : returns {5; 36; 343}

  [[4; 5]; [7; 8]] ENT 4 ^ : returns [[7,641; 9,000]; [12,600; 14,841]]

4.7.17 Power of 10

10 ^ value

Returns 10 raised to the power of value.

Data Types: integer, floating point, complex, table, matrix

Category: math

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  10 ^ -1.23 returns 0.0589

  10 ^ (5; 1.4142) returns (-99,342.6510; -11,447.1697)

  10 ^ {4.2; 1.65; 3.96} returns {15848.9319; 44.6684; 9120.1084}

- Order of Operations and Chain Input Modes

  1.23 +/- 10^ returns 0.0589

- RPN Input Mode

  1.23 ENT +/- 10^ : returns 0.0589

  (5; 1.4142) 10^ : returns (-99,342.6510; -11,447.1697)

  {4.2; 1.65; 3.96} 10^ : returns {15,848.9319; 44.6684; 9,120.1084}

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4.7.18 Present Value

tvmpv(N; I%; PMT; FV)

Returns the present value of a time value of money (TVM) problem. Positive values mean a cash inflow while negative numbers mean a cash outflow. This function is only available if p1 Finance Lib is installed.

- **FV:** future value. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **PMT:** periodic payment amount. Positive values mean a cash inflow while negative numbers mean a cash outflow.
- **I%:** yearly interest rate expressed as a percentage
- **N:** total number of periods

Category: finance

Input Modes: algebraic

Examples:

tvmpv(240; 5; 120; 300) : returns -18,293.63

tvmpv(N; I%; PMT; FV; P/Y; C/Y; B)

Returns the present value of a time value of money (TVM) problem. Positive values mean a cash inflow while negative numbers mean a cash outflow. This function is only available if p1 Finance Lib is installed. Same variables as above except

- **P/Y:** payment periods per year. If not included, it is assumed to be 12.
- **C/Y:** interest compounding periods per year. If not included, it is assumed to be 12.
- **B:** payment timing (0 for end of period, 1 for beginning of period). If not included, it is assumed to be 0.

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  tvmpv(240; 5; 120; 300; 12; 12; 0) : returns -18,293.63

- RPN Input Mode

  240 ENT 5 ENT 120 ENT 300 ENT 12 ENT 12 ENT 0 tvmpv : returns -18,293.63

4.7.19 Product

prod(list)

Returns the product of elements in list. In other words, each elements is multiplied together. List may be a table or matrix of integer, double or complex data types.

Data Types: table, matrix

Category: stats

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  prod({1; 2; 3; 4; 5}) : returns 120

  prod({ {1; 2; 3};{3; 4; 5} }) : returns 360

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- RPN Input Mode

  {1; 2; 3; 4; 5} prod : returns 120

4.7.20 Profitability Index

CfoProf(I%; CFAmntList)

Returns the profitability index of the given cash flow. This function is only available if p1 Finance Lib is installed.

- **I%:** periodic interest rate as a percentage.
- **CFAmntList:** list containing cash flow amounts where the first element is the initial cash flow.
- **CFFreqList:** list in which each element specifies the frequency of occurrence for a consecutive cash flow amount in CFList.

Category: finance

Input Modes: algebraic

Examples:

CfoProf(12; {-5000; 4000; 3000; 3000}) : returns 1.62

CfoProf(I%; CFAmntList; CFFreqList)

same as above

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  CfoProf(12; {-5000; 4000; 3000}; {1; 1; 2}) : returns 1.62

- RPN Input Mode

  12 ENT {-5000; 4000; 3000} ENT {1; 1; 2} CfoProf : returns 1.62

4.7.21 1st Quartile

The matematics community has several methods for computing the first and third quartiles. *powerOne Graph* uses Tukey's method, which includes the median in the quartile calculation. This may be different on other calculators.

quartile1(datalist)

Returns the first quartile of a list or vector.

- **datalist:** a list containing values used in the calculation.

Data Types: table, matrix

Category: stats

Input Modes: algebraic

Examples:

quartile1({1; 2; 3; 4; 5}) : returns 2

quartile1(datalist; occlist)

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Same as above except:

- **occlist:** a list, the same size as datalist, containing the number of occurrences of each corresponding value in datalist. Note that if occlist is not provided for functions that take occlist as an optional argument, the function treats each entry in datalist as a single occurrence.

Data Types: table, matrix

Category: stats

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  quartile1({1; 2; 3; 4; 5}; 1) : returns 2

  quartile1({1; 2; 3; 4; 5}; {2; 4; 4; 6; 6}) : returns 2

- RPN Input Mode

  {1; 2; 3; 4; 5} ENT 1 quartile1 : returns 2

  {1; 2; 3; 4; 5} ENT {2; 4; 4; 6; 6} quartile1 : returns 2

4.7.22 3rd Quartile

The matematics community has several methods for computing the first and third quartiles. *powerOne Graph* uses Tukey's method, which includes the median in the quartile calculation. This may be different on other calculators.

quartile3(datalist)

Returns the third quartile of a list or vector.

- **datalist:** a list containing values used in the calculation.

Data Types: table, matrix

Category: stats

Input Modes: algebraic

Examples:

quartile3({1; 2; 3; 4; 5}) : returns 4

quartile3(datalist; occlist)

Same as above except:

- **occlist:** a list, the same size as datalist, containing the number of occurrences of each corresponding value in datalist. Note that if occlist is not provided for functions that take occlist as an optional argument, the function treats each entry in datalist as a single occurrence.

Data Types: table, matrix

Category: stats

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  quartile3({1; 2; 3; 4; 5}; 1) : returns 4

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quartile3({1; 2; 3; 4; 5}; {2; 4; 4; 6; 6}) : returns 5

- RPN Input Mode

  {1; 2; 3; 4; 5} ENT 1 quartile3 : returns 4

  {1; 2; 3; 4; 5} ENT {2; 4; 4; 6; 6} quartile3 : returns 5

4.7.23 Quotation Marks

" "

Quotation marks are used to denote text strings. Certain functions, such as solving(), fnInt, and nDeriv, require text strings.

Category: calc

Input Modes: algebraic, RPN

4.8 R

This section covers functions beginning with the letter R.

4.8.1 Radians to Degrees Conversion

degrees(value)

Returns degrees equivalent of value radians.

Data Types: integer, floating point, table, matrix

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  degrees(2*pi) returns 360

- Order of Operations and Chain Input Modes

  2 * pi = degrees : returns 360

- RPN Input Mode

  2 ENT pi * degrees : returns 360

4.8.2 Random Binomial Test

RandBin(n; p)

Returns a random integer which simulates the number of successful results of a binomial test with n trials and probability p of success on each trial. This function is only available if p1 Stats Lib is installed.

- **n:** the number of trials between 0 and n. Must be an integer number greater than 0.
- **p:** the probability of success. Must be a floating point number between 0 and 1.

Category: prob

Input Modes: algebraic

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Examples:

RandBin(10; 0.2) : returns a random integer between 0 and 10

RandBin(n; p;numsimulations)

Same as above except returns a list of random integers:

- **numsimulations:** number of times to repeat the simulation. Must be an integer greater than 0 if entered.

Category: prob

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  RandBin(50; 0.4; 10) : returns list of 10 random integers, each with a value between 0 and 50

- RPN Input Mode

  50 ENT .4 ENT 1 randBin : returns list of 10 random integers, each with a value between 0 and 50

  50 ENT .4 ENT 10 randBin : rreturns list of 10 random integers, each with a value between 0 and 50

4.8.3 Random Integer

randInt(lower; upper)

Returns a random integer from a discrete uniform distribution with the specified bounds (lower <= random number <= upper).

- **lower:** lower limit for the random integer. Must be an integer.
- **upper:** upper limit for the random integer. Must be an integer larger than lower.

Category: prob

Input Modes: algebraic

Examples:

randInt(2; 4) : returns single random integer between 2 and 4

randInt(lower; upper; numsimulations)

Same as above except returns a list of random integers:

- **numsimulations:** number of times to repeat the simulation. Must be an integer greater than 0 if entered.

Category: prob

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  randInt(1; 10; 5) : returns list of 5 random integers, each with a value between 1 and 10

- RPN Input Mode

  1 ENT 10 ENT 1 randInt : returns single random number where 1 <= number <= 10

  1 ENT 10 ENT 5 randInt : returns list of 5 random numbers where 1 <= list <= 10

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4.8.4 Random Normal

randNorm(mean; stddev)

Returns a random floating point number, which is a possible value for x in the Normal distribution that has the given parameters. The result will be weighted by the distribution, hence most results will lie in the interval mean-3(stddev) to mean+3(stddev). This function is only available if p1 Stats Lib is installed.

- **mean:** mean of the distribution.
- **stddev:** standard deviation of the distribution. Must be a positive integer or real number

Category: prob

Input Modes: algebraic

Examples:

randNorm(1; 0.3) : returns single random number

randNorm(mean; stddev; numsimulations)

Same as above except returns a list of random numbers:

- **numsimulations:** number of times to repeat the simulation. Must be an integer > 0 if entered.

Category: prob

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  randNorm(2; 0.4; 10) : returns list of 5 random numbers

- RPN Input Mode

  2 ENT .4 ENT 1 randNorm : returns single random number

  2 ENT .4 ENT 10 randNorm : returns list of 10 random numbers

4.8.5 Random Number

rand()

Returns a random floating point number from a uniform distribution within the bounds 0 <= random number <= 1. The number of decimal places is set based on the current decimal setting preference.

Category: prob

Input Modes: algebraic, order of operations, chain

Examples:

- Algebraic, Order of Operations and Chain Input Modes

  rand() : returns single random number in the range 0 <= random number <= 1

rand(numsimulations)

Same as above except returns a list of random floating point numbers:

- **numsimulations**: number of times to repeat the simulation. Must be an integer > 0 if entered.

Category: prob

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Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  rand(5) : returns list of 5 random numbers in the range 0 <= random number <= 1

- RPN Input Mode

  1 rand : returns single random number in the range 0 <= random number <= 1

  6 rand : returns list of 6 random numbers in the range 0 <= random number <= 1

4.8.6 Random Table

randT(rows; columns)

Returns a table with each cell containing a random floating point number generated from a uniform distribution within the bounds 0 <= random number <= 1.

- **row:** number of rows in the table. Must be an integer > 0.
- **column:** number of columns in the table. Must be an integer > 0.

Category: prob

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  randT(2; 2) : returns a 2x2 table filled with random floating point numbers in the range 0 <= random number <= 1

- RPN Input Mode

  2 ENT 2 randT : returns a 2x2 table filled with random floating point numbers in the range 0 <= random number <= 1

4.8.7 Random Table of Integers

randTInt(rows; columns; lower; upper)

Returns a table with each cell containing a random integer number generate from a discrete uniform distribution with the bounds lower <= random number <= upper.

- **row:** number of rows in the table. Must be an integer > 0.
- **column:** number of columns in the table. Must be an integer > 0.
- **lower:** lower limit for the random integer. Must be an integer.
- **upper:** upper limit for the random integer. Must be an integer.

Category: prob

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  randTInt(2; 2; 1; 10) : returns a 2x2 table filled with random integers each with a value between 1 and 10

- RPN Input Mode

  2 ENT 2 ENT 1 ENT 10 randTInt : returns a 2x2 table filled with random integers each with a value between 1 and 10

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4.8.8 Reciprocal

1 / value

Returns 1 divided by value.

Data Types: integer, floating point, complex, table, matrix.

Category: math

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  1/15 : returns 0.0667

  1/89.56 : returns 0.0112

  1/(5; 1.4142) : returns (0.1852; -0.0524)

  { {1; 2}; {3; 4} } : returns { {1; 0.5}; {0.3333; 0.25} }

- Order of Operations and Chain Input Modes

  15 1/x : returns 0.0667

  89.56 1/x : returns 0.0112

- RPN Input Mode

  15 1/x : returns 0.0667

  89.56 1/x : returns 0.0112

  (5; 1.4142) 1/x : returns (0.1852; -0.0524)

  { {1; 2}; {3; 4} } 1/x : returns { {1; 0.5}; {0.3333; 0.25} }

4.8.9 Rectangular to Polar Conversion

abs(x; y)

Returns polar coordinate r given rectangular coordinates x and y.

Data Types: complex

Category: number

Input Modes: algebraic

Examples:

abs(6; 3) : returns 6.7082

abs(12.5; [[1; 2]; [3; 4]]) : returns [[12.5399; 12.6590]; [12.8550; 13.1244]]

theta(x; y)

Returns polar coordinate q given rectangular coordinates x and y.

Data Types: integer, floating point, complex, table, matrix

Category: cmplx

Input Modes: algebraic

Examples:

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theta(5; 4) : returns 0.6747 when Trig Mode set to radians

theta([[3; 4]; [5; 6]]; [1; 2]; [7; 8]]) : returns [[0.3217; 0.4636]; [0.9505; 0.92729]] when Trig Mode set to radians

theta(5; 4) : returns 38.6598 when Trig Mode set to degrees

theta([[3; 4]; [5; 6]]; [1; 2]; [7; 8]]) : returns [[18.4349; 26.5651]; [54.4623; 53.1301]] when Trig Mode set to degrees

theta(value)

Returns the polar angle of a complex number.

Data Types: integer, floating point, complex, table, matrix

Category: cmplx

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  theta((5; 1.4142)) : returns 0.2756 when Trig Mode Preferences set to radians

  theta((5; 1.4142)) : returns 15.7930 when Trig Mode Preferences set to degrees

- RPN Input Mode

  (5; 1.4142) theta : returns 0.2756 when Trig Mode Preferences set to radians

  (5; 1.4142) theta : returns 15.7930 when Trig Mode Preferences set to degrees

4.8.10 Rectangular, Convert To

toRect(value)

Returns a complex number in rectangular format from value.

Data Types: boolean, integer, floating point, complex, table, matrix

Category: cmplx

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  toRect(15.5) : returns (15.5; 0.0)

  toRect((25; @30)) : returns (3.8563; -24.7008)

  toRect([[1; 2]; [3; 4]]) : returns [[(1.0; 0.0); (2.0; 0.0)]; [(3.0; 0.0); (4.0; 0.0)]]

- RPN Input Mode

  15.5 toRect : returns (15.5; 0.0)

  [[1; 2]; [3; 4]] toRect : returns [[(1.0; 0.0); (2.0; 0.0)]; [(3.0; 0.0); (4.0; 0.0)]]

4.8.11 Redimension

redim(value; length)

Returns a list or vector (depending on the data type of value) containing data from value. length contains the size of the

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new list or vector.

Data Types: matrix, table

Category: matrix

Input Modes: algebraic

Examples:

redim({1; 2; 3}; 5) : returns {1; 2; 3; 0; 0} or

1
2
3
0
0

redim(value; row; col)

Returns a matrix or table (depending on the data type of value) containing data from value. row, col are the number of rows and columns respectively for the new structure.

Data Types: matrix, table

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  redim([[1; 2; 3]; [4; 5; 6]]; 3; 5) : returns [[1; 2; 3; 0; 0]; [4; 5; 6; 0; 0]; [0; 0; 0; 0; 0]] or

1	2	3	0	0
4	5	6	0	0
0	0	0	0	0

- RPN Input Mode (HP48 Enter Mode Preference setting)

  [[1; 2; 3]; [4; 5; 6]] ENT 3 ENT 5 redim : returns [[1; 2; 3; 0; 0]; [4; 5; 6; 0; 0]; [0; 0; 0; 0; 0]] or

1	2	3	0	0
4	5	6	0	0
0	0	0	0	0

4.8.12 Reduced Row-Echelon Form

rref(matrix)

Returns the reduced row-echelon form of a matrix.

Data Types: matrix

Category: matrix

Input Modes: algebraic, RPN

Examples:

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- Algebraic Input Mode

  rref([[1; 2; 6]; [3; 4; 8]]) : returns [[1; 0; -4]; [0; 1; 5]]

  rref([[5; 11; 120]; [22; 28;82]]) : returns [[1; 0; -24.0980]; [0; 1; 21.8627]]

- RPN Input Mode

  [[1; 2; 6]; [3; 4; 8]] rref : returns [[1; 0; -4]; [0; 1; 5]]

  [[5; 11; 120]; [22; 28; 82]] rref : returns [[1; 0; -24.0980]; [0; 1; 21.8627]]

4.8.13 Root

root(y; x)

Returns x^{th} root of y.

Data Types: integer, floating point, complex, table. Note: certain combinations do not work.

Category: math

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  root(27; 3) : returns 3

  root(84.5; 5) : returns 2.4287

  root((5; 1.4142); 3) : returns (1.7247; 0.1589)

  root({ {41; 53}; {65; 78} }; 3) : returns { {3.4482; 3.7563}; {4.0207; 4.2727} }

- Order of Operations and Chain Input Modes

  27 $^{y}\sqrt{x}$ 3 = : returns 3

  84.5 $^{y}\sqrt{x}$ 5 = : returns 2.4287

- RPN Input Mode

  27 ENT 3 $^{y}\sqrt{x}$: returns 3

  84.5 ENT 5 $^{y}\sqrt{x}$: returns 2.4287

  (5; 1.4142) ENT 4 $^{y}\sqrt{x}$ returns (1.5062; 0.1040)

  { {41; 53}; {65; 78} } ENT 3 $^{y}\sqrt{x}$: returns { {3.4482; 3.7563}; {4.0207; 4.2727}}

4.8.14 Round

round(value)

Returns value rounded to the displayed number of decimal places.

- **value:** the value to round. Its data type must be integer, floating point, complex, table, or matrix.

Category: number

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

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round() with one parameter always rounds to the nearest integer.

- Order of Operations and Chain Input Modes

  5.1234 rnd with Decimal Setting preference set to 3 : returns 5.123

  52.1235 rnd with Decimal Setting preference set to 3 : returns 52.124

- RPN Input Mode

  5.1234 rnd with Decimal Setting preference set to 3 : returns 5.123

  52.1235 rnd with Decimal Setting preference set to 3 : returns 52.124

  (5; 1.414213562373) rnd with Decimal Setting preference set to 6 : returns (5; 1.414214)

  [[1.234; 2.3]; [3.356789; 4]] rnd with Decimal Setting preference set to 2 : returns [[1.23; 2.3]; [3.36; 4]]

round(value; #decimals)

Returns value rounded to the designated number of decimal places.

- **#decimals:** the number of decimal places to round valueA. This is optional, must be an integer number, and must be in the range 0 <= #decimals <= 10. If #decimals is not designated, value will be rounded to the Decimal Setting preference.

Category: number

Input Modes: algebraic, RPN

Examples:

round(5.1234; 3) : returns 5.123

round(5.1235; 3) : returns 5.124

round((5; 1.414213562373); 6) : returns (5; 1.414214)

round([[1.234; 2.3]; [3.356789; 4]]; 2) : returns [[1.23; 2.3]; [3.36; 4]]

4.8.15 Row Add & Multiply

rowMA(matrix; value; row A; rowB)

Returns a table/matrix with rowA of matrix multiplied by value, added to rowB and stored in rowB.

Data Types: table, matrix. Note: certain combinations do not work.

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  rowMA([[1; 2; 3]; [4; 5; 6]; [7; 8; 9]]; 5; 2; 3) : returns [[1; 2; 3]; [4; 5; 6]; [27; 33; 39]]

  rowMA({1; 2; 3; 4}; 4; 3; 4) : returns {1; 2; 3; 16}

- RPN Input Mode

  [[1; 2; 3]; [4; 5; 6]; [7; 8; 9]] ENT 5 ENT 2 ENT 3 rowMA : returns [[1; 2; 3]; [4; 5; 6]; [27; 33; 39]]

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4.8.16 Row Addition

rowA(matrix; rowA; rowB)

Returns a matrix/table with rowA of matrix added to rowB and stored in rowB.

Data Types: table, matrix. Note: certain combinations do not work.

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  rowA([[1; 2; 3]; [4; 5; 6]; [7; 8; 9]]; 1; 3) : returns [[1; 2; 3]; [4; 5; 6]; [8; 10; 12]]

  rowA({1; 2; 3; 4}; 1; 4) : returns {1; 2; 3; 5}

- RPN Input Mode

  [[1; 2; 3]; [4; 5; 6]; [7; 8; 9]] ENT 1 ENT 3 rowA : returns [[1; 2; 3]; [4; 5; 6]; [8; 10; 12]]

  {1; 2; 3; 4} ENT 1 ENT 4 rowA : returns {1; 2; 3; 5}

4.8.17 Row Multiplication

rowM(matrix; value; row)

Returns a matrix/table with row of matrix multiplied by value and stored in row.

Data Types: table, matrix

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  rowM([[1; 2; 3]; [4; 5; 6]; [7; 8; 9]]; 5; 2) : returns [[1; 2; 3]; [20; 25; 30]; [7; 8; 9]]

  rowM({1; 2; 3; 4}; 4; 3) : returns {1; 2; 12; 4}

- RPN Input Mode

  [[1; 2; 3]; [4; 5; 6]; [7; 8; 9]] ENT 5 ENT 2 rowM : returns [[1; 2; 3]; [20; 25; 30]; [7; 8; 9]]

  {1; 2; 3; 4} ENT 4 ENT 3 rowM : returns {1; 2; 12; 4}

4.8.18 Row Norm

rNorm(matrix)

Returns the largest value of the sums of each row of the matrix or table.

Data Types: table, matrix

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

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rNorm([[1; 2]; [3; 4]]) : returns 7

rNorm({ {1; 2; 3} }) : returns 6

- RPN Input Mode

  [[1; 2]; [3; 4]] rNorm : returns 7

  { {1; 2; 3} } rNorm : returns 6

4.8.19 Row-Echelon Form

ref(matrix)

Returns the row-echelon form of a matrix.

Data Types: matrix

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  ref([[1; 2]; [3; 4]]) : returns [[1; 1.3333]; [0.0; 1]]

  ref([[5; 11]; [22; 28]]) : returns [[1; 1.2727]; [0.0; 1]]

- RPN Input Mode

  [[1; 2]; [3; 4]] ref : returns [[1; 1.3333]; [0.0; 1]]

  [[5; 11]; [22; 28]] ref : returns [[1; 1.2727]; [0.0; 1]]

4.9 S

This section covers functions beginning with the letter S.

4.9.1 Secant

sec(value)

Returns secant of value.

Data Types: integer, floating point, table, matrix

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  sec(0.5236) : returns 1.1547 when Trig Mode Preferences set to Radians

  sec(30) : returns 1.1547 when Trig Mode Preferences set to Degrees

- RPN, Order of Operations and Chain Input Modes

  0.5236 sec : returns 1.1547 when Trig Mode Preferences set to Radians

  30 sec : returns 1.1547 when Trig Mode Preferences set to Degrees

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4.9.2 Semi-Colon

semi-colon (;)

Used to separate arguments in function calls, complex number definitions and table/matrix elements.

Data Types: complex, table, matrix

Category: number

Input Modes: algebraic, RPN

Examples:

{1; 2; 3} : separate rows in table

1
2
3

root(y; x) : separate the y and x variables in the root function call

4.9.3 Sequence Evaluation

seq("expression"; "variable"; begin; end)

Returns list of floating point numbers derived by evaluating the expression with regard to variable.

- **expression:** expression to evaluate. Must be in quotations.
- **variable:** variable within the expression to evaluate. Must be in quotations.
- **begin:** point to start incrementing.
- **end:** point to stop incrementing.

Category: stats

Input Modes: algebraic

Examples:

seq("a*2"; "a"; 1; 5) : returns {2; 4; 6; 8; 10} (or {1*2; 2*2; 2*3; 2*4; 2*5})

seq("expression"; "variable"; begin; end; step)

Returns list of floating point numbers derived by evaluating the expression with regard to variable. Same as above except:

- **step:** how often to evaluate between begin and end. If end > begin, step must be negative. This is optional. If step is not included, default is 1. If there are not an exact number of increments in the range then the last value calculated will be just before the end value.

Category: stats

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  seq("a^2"; "a"; 1; 11; 3) : returns {1; 16; 49; 100} (or {1^2; 4^2; 7^2; 10^2})

- RPN Input Mode

  "a*2" ENT "a" ENT 1 ENT 5 ENT 1 seq : returns {2; 4; 6; 8; 10}

  "a^2" ENT "a" ENT 1 ENT 11 ENT 3 seq : returns {1; 16; 49; 100} or (1^2, 4^2, 7^2, and 10^2)

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4.9.4 Shift Left

value << numbits

Returns result of shifting value to the left by numbits.

Data Types: integer, table, matrix

Category: dev

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  110101_b << 1 : returns 1101010_b

  13_d << 1 : returns 26_d

  [[5; 6]; [7; 8]] << 1 : returns [[10; 12]; [14; 16]] all in decimal base

- RPN Input Mode

  110101_b ENT 1 << →b : returns 1101010_b

  13_d ENT 1 << : returns 26_d

  [[5; 6]; [7; 8]] ENT 1 << : returns [[10; 12]; [14; 16]] all in decimal base

4.9.5 Shift Right

value >> numbits

Returns result of shifting value to the right by numbits.

Data Types: integer, table, matrix

Category: dev

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  110101_b >> 1 : returns 11010_b

  13_d >> 1 : returns 6_d

  [[5; 6]; [7; 8]] >> 1 : returns [[2; 3]; [3; 4]] all in decimal base

- RPN Input Mode

  110101_b ENT 1 >> →b : returns 11010_b

  13_d ENT 1 >> : returns 6_d

  [[5; 6]; [7; 8]] ENT 1 >> : returns [[2; 3]; [3; 4]] all in decimal base

4.9.6 Show

show

Shows all available decimal places.

Data Types: integer, floating point

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Category: number

Input Modes: RPN, order of operations, chain

4.9.7 Sigma

sigma("expression"; "variable"; begin; end)

Returns the sum of values derived by evaluating the expression with regard to variable.

- **expression:** expression to evaluate. Must be in quotations.
- **variable:** variable within the expression to evaluate. Must be in quotations.
- **begin:** point to start incrementing.
- **end:** point to stop incrementing.

Category: stats

Input Modes: algebraic

Examples:

sigma("a*1"; "a"; 1; 5) : returns 15 (or 1 + 2 + 3 + 4 + 5)

sigma("expression"; "variable"; begin; end; step)

Returns the sum of values derived by evaluating the expression with regard to variable. Same as above except:

- **step:** how often to evaluate between begin and end. If end > begin, step must be negative. This is optional. If step is not included, default is 1. If there are not an exact number of increments in the range then the last value calculated will be just before the end value.

Category: stats

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  sigma("a^2"; "a"; 1; 11; 3) returns 166 or (1^2 + 4^2 + 7^2 + 10^2)

- RPN Input Mode

  "a*1" ENT "a" ENT 1 ENT 5 ENT 1 sigma : returns 15

  "a^2" ENT "a" ENT 1 ENT 11 ENT 3 sigma : returns 166 or (1^2 + 4^2 + 7^2 + 10^2)

4.9.8 Sign

sign(value)

Returns –1 if value is less than 0, 0 if value is 0, or 1 otherwise.

Data Types: integer, floating point, table, matrix

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  sign(-5.67) : returns –1

  sign(0) : returns 0

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sign({ {0.0001; -9999}; {6.5; -5} }) : returns { {1; -1}; {0; -1} }

- Order of Operations and Chain Input Modes

  5.67 +/- sign : returns –1

  5 sign : returns 1

- RPN Input Mode

  5.67 ENT +/- sign : returns –1

  0 sign : returns 0

  { {0.0001; -9999}; {0; -5} } sign : returns { {1; -1}; {0; -1} }

+/–

Either inserts a negative sign (algebraic and RPN input modes) or changes the sign of the value in the view window (order of operations and chain input modes). This software does not differentiate between negate sign and subtract in algebraic and RPN input modes.

4.9.9 Sine

sin(value)

Returns sine of value.

Data Types: integer, floating point, complex, table, matrix

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  sin(30) : returns -0.9880 when Trig Mode Preferences set to Radians

  sin(30) : returns 0.5 when Trig Mode Preferences set to Degrees

- RPN, Order of Operations and Chain Input Modes

  30 sin : returns -0.9880 when Trig Mode Preferences set to Radians

  30 sin : returns 0.5 when Trig Mode Preferences set to Degrees

4.9.10 Single Payment Future Value

spfv(percent; periods)

Returns the future value of a single $1.00 payment. This function is only available if p1 Finance Lib is installed.

- **percent:** interest rate per compounding period expressed as a percentage.
- **periods:** number of payments.

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

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spfv(5; 360) : returns 42,476,396.41

spfv(5/12; 360) : returns 4.4677

spfv(8; 0) : returns 1

spfv(0; 144) : returns 1

- RPN Input Mode

  5 ENT 360 spfv : returns 42,476,396.41

4.9.11 Single Payment Present Value

sppv(percent; periods)

Returns the present value of a single $1.00 payment. This function is only available if p1 Finance Lib is installed.

- **percent:** interest rate per compounding period expressed as a percentage.
- **periods:** number of payments.

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  sppv(5; 360) : returns 2.354e-8

  sppv(5/12; 360) : returns 0.2238

  sppv(8; 0) : returns 1

  sppv(0; 144) : returns 1

- RPN Input Mode

  5 ENT 360 sppv : returns 2.354e-8

4.9.12 Solve

solve()

The solver uses a non-symbolic iterative approach to solve expressions for a particular variable. Because the method is iterative it can take a significant amount of time to complete and may fail to return a result or return a result that is inexact but within the tolerance permitted when using floating point math. This function is not required when creating templates. The function returns a floating point number containing the value for variable that causes expression to be equal to zero. expression and variable are both strings. The algorithm will use default minimum and maximum bracket values of –1E300 and 1E300 respectively. The iteration methodology is as follows: It will take the mid-point between the minimum and maximum and step towards the maximum bracket until a sign change is detected. It will then search for a root around the sign change using Brent's method. If the search in a) does not yield a sign change then it steps negatively towards the minimum bracket from the mid-point between the bracket values until a sign change is found. It will then search for a root around the sign change using Brent's method. If a sign change is not found in a) or b) it gives up.

The following forms are available:

solve(expression; variable)

- **expression:** the expression to solve for. Must be in quotations.
- **variable:** the variable within the expression to solve for. Must be in quotations.

Category: math

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Input Modes: algebraic

Examples:

solve("x*5=32"; "x") : returns 6.4

solve(expression; variable; guess)

- **expression:** the expression to solve for. Must be in quotations.
- **variable:** the variable within the expression to solve for. Must be in quotations.
- **guess:** starting point. Must be an integer of floating point number.

Category: math

Input Modes: algebraic

Examples:

solve("5=x^2-3";"x";2.5) returns 2.8284

solve(expression; variable; lower; upper)

- **expression:** the expression to solve for. Must be in quotations.
- **variable:** the variable within the expression to solve for. Must be in quotations.
- **lower:** lower boundary to begin bracketing. Must be an integer of floating point number.
- **upper:** upper boundary to begin bracketing. Must be an integer of floating point number.

Category: math

Input Modes: algebraic

Examples:

solve("y=x^2-3";"x";2.5;-6,6) : returns -3.3166 where y=8

4.9.13 Solving

solving()

Returns the name of the variable currently being solved for. Using solving when creating templates makes it possible to calculate multiple equations in the same template. The variable name should be in quotations. Note: 'Auto-compute' template preferences should be turned off if the template uses this function. See the Creating Templates section for more information.

Category: templates only

Input Modes: algebraic, RPN, order of operations, chain

Examples:

if (solving()=="valueA"; valueB+valueC-valueA; 5+valueA-valueA) : returns valueB+valueC when calculating valueA or 5 when calculating valueB or valueC. Since valueA is not included in any calculations, setting valueA - valueA offers valueA for calculation but does not use it in the calculation itself.

4.9.14 Sort Ascending

sortA(struct)

Returns a structure with all elements in struct sorted in ascending order.

Data Types: table, matrix

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Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  sortA([[6; 8; 2]; [1; 9; 4]; [7; 3; 5]]) : returns [[1; 2; 3]; [4; 5; 6]; [7; 8; 9]] or

1	2	3
4	5	6
7	8	9

  sortA({3; 4; 3; 1}) : returns {1; 3; 3; 4} or

1
3
3
4

- RPN Input Mode (HP48 Enter Mode Preference setting)

  [[6; 8; 2]; [1; 9; 4]; [7; 3; 5]] sortA : returns [[1; 2; 3]; [4; 5; 6]; [7; 8; 9]] or

1	2	3
4	5	6
7	8	9

  {3; 4; 3; 1} sortA : returns {4; 3; 3; 1} or

1
3
3
4

4.9.15 Sort Descending

sortD(struct)

Returns a structure with all elements in struct sorted in descending order.

Data Types: table, matrix

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  sortD([[6; 8; 2]; [1; 9; 4]; [7; 3; 5]]) : returns [[9; 8; 7]; [6; 5; 4]; [3; 2; 1]] or

9	8	7
6	5	4
3	2	1

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sortD({3; 4; 3; 1}) : returns {1; 3; 3; 4} or

4
3
3
1

- RPN Input Mode (HP48 Enter Mode Preference setting)

  [[6; 8; 2]; [1; 9; 4]; [7; 3; 5]] sortD : returns [[9; 8; 7]; [6; 5; 4]; [3; 2; 1]] or

9	8	7
6	5	4
3	2	1

  {3; 4; 3; 1} sortD : returns {4; 3; 3; 1} or

4
3
3
1

4.9.16 Square

value ^ 2

Returns value multiplied by 2.

Data Types: integer, floating point, complex, table

Category: math

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  5 ^ 2 : returns 25

  -3 ^ 2 : returns -9 (Preference setting -2^2=-4)

  -3 ^ 2 : returns 9 (Preference setting -2^2=4)

  (5; 1.4142) ^ 2 : returns (23; 14.1420)

  { {1; 2}; {3; 4} } ^ 2 : returns { {1; 4}; {9; 16} }

  [[1; 2]; [3; 4]] ^ 2 : returns [[7; 10]; [15; 22]]

- Order of Operations and Chain Input Modes

  5 x^2 : returns 25

  3 +/- x^2 : returns 9

- RPN Input Mode

  5 x^2 : returns 25

  -3 x^2 : returns 9

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(5; 1.4142) x^2 : returns (23; 14.1420)

{ {1; 2}; {3; 4} } x^2 : returns { {1; 4}; {9; 16} }

[[1; 2]; [3; 4]] x^2 : returns [[7; 10]; [15; 22]]

4.9.17 Square Root

sqrt(value)

Returns the square root of value.

Data Types: integer, floating point, complex, table

Category: math

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebaic Input Mode

  sqrt(9.9) : returns 3.1464

  sqrt((5; 1.4142)) : returns (2.2795; @0.1378) in radians

  sqrt({ {9; 36}; {81; 4} }) : returns { {3; 6}; {9; 2} }

- Order of Operations and Chain Input Modes

  9.9 √x : returns 3.1464

- RPN Input Mode

  9.9 √x :returns 3.1464

  (5; 1.4142) √x : returns (2.2795; @0.1378) in radians

  { {9; 36}; {81; 4} } √x : returns { {3; 6}; {9; 2} }

4.9.18 Stack

There are special functions for manipulating the stack. These functions can be reached by tapping an item pushed onto the stack or choosing category Stack from the function list and then selecting the desired function. If an item is selected on the stack, the function selected will adjust based on that item. If a stack function is selected from the function list the first item on the stack will be the focal point.

- **Drop:** throws out the item.
- **Duplicate** (dup)**:** copies the item into register 0 (view window/entry line), pushing all others up.
- **Move:** removes the item from its location in the stack and places it in register 0 (view window/entry line).
- **Rotate** (rot)**:** moves the stack in a clockwise direction.
- **Rotate Rvrs** (rotr)**:** moves the stack in a reverse or counter-clockwise direction.
- **Swap:** swaps the item with the contents of register 0 (view window/entry line).

Category: stack (or available by selecting an item on the stack)

Input Modes: RPN

4.9.19 Standard Deviation

stdDev(datalist [; occlist])

Returns the sample standard deviation of the list datalist. occlist is an optional argument that can contain a list of

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occurences corresponding to the values in datalist.

- **datalist:** a list containing values used in the calculation.
- **occlist:** a list, the same size as datalist, containing the number of occurrences of each corresponding value in datalist. occlist is optional for algebraic input mode but required for RPN input mode. Note that if occlist is not provided for functions that take occlist as an optional argument, the function treats each entry in datalist as a single occurrence.

Data Types: table, matrix

Category: stats

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  stdDev({1; 2; 3; 4; 5}) : returns 1.5811

  stdDev({1; 2; 3; 4; 5}; {2; 4; 4; 6; 6}) : returns 1.3355

- RPN Input Mode

  {1; 2; 3; 4; 5} ENT 1 stdDev : returns 1.5811

  {1; 2; 3; 4; 5} ENT {2; 4; 4; 6; 6} stdDev : returns 1.3355

stdDevP(datalist [;occlist])

Returns the population standard deviation of the list datalist. occlist is an optional argument that can contain a list of occurences corresponding to the values in datalist.

- **datalist:** a list containing values used in the calculation.
- **occlist:** a list, the same size as datalist, containing the number of occurrences of each corresponding value in datalist. occlist is optional for algebraic input mode but required for RPN input mode. Note that if occlist is not provided for functions that take occlist as an optional argument, the function treats each entry in datalist as a single occurrence.

Data Types: table, matrix

Category: stats

Input Modes: algebraic, RPN

Examples:

Algebraic Input Mode

stdDevP({1; 2; 3; 4; 5}) : returns 1.4142

stdDevP({1; 2; 3; 4; 5}; {2; 4; 4; 6; 6}) : returns 1.3048

RPN Input Mode

{1; 2; 3; 4; 5} ENT 1 stdDevP : returns 1.4142

{1; 2; 3; 4; 5} ENT {2; 4; 4; 6; 6} stdDevP : returns 1.3048

4.9.20 Straight Line Depreciation

DepSLBV (C; S; L; M; Y) (Book Value)
DepSLDA (C; S; L; M; Y) (Depreciation Amount)
DepSLDV (C; S; L; M; Y) (Depreciation Value)

Book value returns the book value (depreciable value + salvage value) for the asset at the end of the given year. Depreciation amount returns the amount that the asset depreciated during the given year. Depreciation value returns the

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remaining total depreciable value for the asset at the end of the given year. All three are calculated using the straight line method of depreciation. This function is only available if p1 Finance Lib is installed.

- **C:** cost of the depreciable asset
- **S:** salvage value of the depreciable asset
- **L:** life in years of the depreciable asset
- **M:** first month to begin depreciating (1 is January, 12 is December)
- **Y:** year to calculate

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  DepSLBV (150000; 20000; 20; 6; 3) : returns 133,208.33

  DepSLDA (150000; 20000; 20; 6; 3) : returns 6,500

  DepSLDV (150000; 20000; 20; 6; 3) : returns 113,208.33

- RPN Input Mode

  150000 ENT 20000 ENT 20 ENT 6 ENT 3 DepSLBV : returns 133,208.33

  150000 ENT 20000 ENT 20 ENT 6 ENT 3 DepSLDA : returns 6,500

  150000 ENT 20000 ENT 20 ENT 6 ENT 3 DepSLDV : returns 113,208.33

4.9.21 Student-t Cumulative Distribution

tCDF(lower; upper; df)

Returns the Student-t distribution cumulative probability between the specified lower and upper bounds for the given degrees of freedom. This function is only available if p1 Stats Lib is installed.

- **lower:** lower boundary. Must be an integer or floating point number < upper
- **upper:** upper boundary. Must be an integer or floating point number > lower
- **df:** degrees of freedom. Must be an integer > 0

Category: distr

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  tCDF(-1; 2; 5) : returns 7.674e-1

- RPN Input Mode

  -1 ENT 2 ENT 5 tCDF : returns 7.674e-1

4.9.22 Student-t Probability Distribution

tPDF(x; df)

Returns the probability density function (pdf) for the Student-t distribution at the specified value with the given degrees of freedom. This function is only available if p1 Stats Lib is installed.

- **x:** value to analyze. Must be an integer or floating point number
- **df:** degrees of freedom. Must be an integer > 0

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Category: distr

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  tPDF(2; 5) : returns 6.509e-2

- RPN Input Mode

  2 ENT 5 tPDF : returns 6.509e-2

4.9.23 Sub List

sublist(list; start)

Returns a list containing a sublist of list, starting with element start and including all remaining elements in list.

Data Types: matrix, table

Category: matrix

Input Modes: algebraic

Examples:

subList({6; 7; 8; 9}; 3) : returns {8; 9}

sublist(list; start; len)

Returns a list containing a sublist of list, including len elements from list starting with element start.

Data Types: matrix, table

Category: matrix

Input Modes: algebraic, RPN

Examples:

Algebraic Input Mode

subList({6; 7; 8; 9; 10}; 2; 3) : returns {7; 8; 9}

RPN Input Mode

{6; 7; 8; 9} ENT 2 ENT 2 subList : returns {7; 8}

4.9.24 Subtraction

valueA – valueB

returns valueA minus valueB.

Data Types: boolean, integer, floating point, date, complex, table, matrix. Note: certain combinations do not work.

Category: not applicable

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  9.32 - 4.89 : returns 4.43

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(8; 2.2361) - (5; 1.4142) : returns (3; 0.8219)

{ {15; 22}; {8; 89} } - 6 : returns { {9; 16}; {2; 83} }

[[17; 28]; [32; 46]] - [[1; 2]; [3; 4]] : returns [[16; 26]; [29; 42]]

- Order of Operations Input Mode

  9.32 - 4.89 = : returns 4.43

- Chain Input Mode

  9.32 - 4.89 = : returns 4.43

- RPN Input Mode

  9.32 ENT 4.89 - : returns 4.43

  (8; 2.2361) ENT (5; 1.4142) - : returns (3; 0.8219)

  { {15; 22}; {8; 89} } ENT 6 - : returns { {9; 16}; {2; 83} }

  [[17; 28]; [32; 46]] ENT [[1; 2]; [3; 4]] - : returns [[16; 26]; [29; 42]]

4.9.25 Sum of the Year's Digits Depreciation

DepSOYDBV (C; S; L; M; Y) (Book Value)
DepSOYDDA (C; S; L; M; Y) (Depreciation Amount)
DepSOYDDV (C; S; L; M; Y) (Depreciation Value)

Book value returns the book value (depreciable value + salvage value) for the asset at the end of the given year. Depreciation amount returns the amount that the asset depreciated during the given year. Depreciation value returns the remaining total depreciable value for the asset at the end of the given year. All three are calculated using the sum of the year's digits method of depreciation. This function is only available if p1 Finance Lib is installed.

- **C:** cost of the depreciable asset
- **S:** salvage value of the depreciable asset
- **L:** life in years of the depreciable asset
- **M:** first month to begin depreciating (1 is January, 12 is December)
- **Y:** year to calculate

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  DepSOYDBV (150000; 20000; 20; 6; 3) : returns 119,357.14

  DepSOYDDA (150000; 20000; 20; 6; 3) : returns 11,400.79

  DepSOYDDV (150000; 20000; 20; 6; 3) : returns 99,357.14

- RPN Input Mode

  150000 ENT 20000 ENT 20 ENT 6 ENT 3 DepSOYDBV : returns 119,357.14

  150000 ENT 20000 ENT 20 ENT 6 ENT 3 DepSOYDDA : returns 11,400.79

  150000 ENT 20000 ENT 20 ENT 6 ENT 3 DepSOYDDV : returns 99,357.14

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4.9.26 Sum of x-Squared

sumX2(datalist)

Returns the sum of the squares of the values in the list datalist.

- **datalist:** a list containing values used in the calculation.

Data Types: table, matrix

Category: stats

Input Modes: algebraic

Examples:

sumX2({1; 2; 3; 4; 5}) : returns 55

sumX2(datalist; occlist)

Same as above except:

- **occlist:** a list, the same size as datalist, containing the number of occurrences of each corresponding value in datalist. Note that if occlist is not provided for functions that take occlist as an optional argument, the function treats each entry in datalist as a single occurrence.

Data Types: table, matrix

Category: stats

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  sumX2({1; 2; 3; 4; 5}; 1) : returns 55

  sumX2({1; 2; 3; 4; 5}; {2; 4; 4; 6; 6}) : returns 300

- RPN Input Mode

  {1; 2; 3; 4; 5} ENT 1 sumx2 : returns 55

  {1; 2; 3; 4; 5} ENT {2; 4; 4; 6; 6} sumX2 : returns 300

4.9.27 Summation

sumX(datalist)

Returns the sum of the values in the list datalist. occlist is an optional argument that can contain a list of occurences corresponding to the values in datalist.

- **datalist:** a list containing values used in the calculation.

Data Types: table, matrix

Category: stats

Input Modes: algebraic

Examples:

sumX({1; 2; 3; 4; 5}) : returns 15

sumX(datalist; occlist)

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Same as above except:

- **occlist:** a list, the same size as datalist, containing the number of occurrences of each corresponding value in datalist. Note that if occlist is not provided for functions that take occlist as an optional argument, the function treats each entry in datalist as a single occurrence.

Data Types: table, matrix

Category: stats

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  sumX({1; 2; 3; 4; 5}; 1) : returns 15

  sumX({1; 2; 3; 4; 5}; {2; 4; 4; 6; 6}) : returns 76

- RPN Input Mode

  {1; 2; 3; 4; 5} ENT 1 sumX : returns 15

  {1; 2; 3; 4; 5} ENT {2; 4; 4; 6; 6} sumX : returns 76

Also see the function Sigma.

4.9.28 Swap Rows

rowSwap(matrix; rowA; rowB)

Returns a table/matrix with rowA swapped with rowB.

Data Types: table, matrix

Category: stats

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  rowSwap([[1; 2; 3]; [4; 5; 6]; [7; 8; 9]]; 1; 3) returns [[7; 8; 9]; [4; 5; 6]; [1; 2; 3]]

- RPN Input Mode

  [[1; 2; 3]; [4; 5; 6]; [7; 8; 9]] ENT 1 ENT 3 rowSwap : returns [[7; 8; 9]; [4; 5; 6]; [1; 2; 3]]

4.10 T-Z

This section covers functions beginning with the letters T through Z.

4.10.1 Table to Matrix Conversion

toMatrix(value)

Returns a matrix/vector from a table/list value.

Data Types: matrix

Category: matrix

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Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  toMatrix({ {1; 2}; {3; 4} }) : returns [[1; 2]; [3; 4]]

- RPN Input Mode

  { {1; 2}; {3; 4} } toMatrix : returns [[1; 2]; [3; 4]]

4.10.2 Tangent

tan(value)

Returns tangent of value.

Data Types: integer, floating point, complex, table, matrix

Category: trig

Input Modes: algebraic, RPN, order of operations, chain

Examples:

- Algebraic Input Mode

  tan(0.7854) : returns 1 when Trig Mode Preferences set to Radians

  tan(45) : returns 1 when Trig Mode Preferences set to Degrees

- RPN, Order of Operations and Chain Input Modes

  0.7854 tan : returns 1 when Trig Mode Preferences set to Radians

  45 tan : returns 1 when Trig Mode Preferences set to Degrees

4.10.3 Theta

See Rectangular to Polar Conversion.

4.10.4 Today

today()

This function can only be used within a formula – the returned value cannot be viewed in a template. Returns a date type representing current date and time.

Category: date

Input Modes: algebraic, RPN

Examples:

today() : returns today's date and the current time (e.g, 8/1/03 at 6:09 pm)

4.10.5 Total

CfoTot(CFAmntList)

Returns the sum of the given cash flow and is similar to function Summation. This function is only available if p1 Finance Lib is installed.

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- **CFAmntList:** list containing cash flow amounts where the first element is the initial cash flow.
- **CFFreqList:** list in which each element specifies the frequency of occurrence for a consecutive cash flow amount in CFList.

Category: finance

Input Modes: algebraic

Examples:

CfoTot({-5000; 4000; 3000; 3000}) : returns 5,000

CfoTot(CFAmntList; CFFreqList)

same as above

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  CfoTot({-5000; 4000; 3000}; {1; 1; 2}) : returns 5,000

- RPN Input Mode

  {-5000; 4000; 3000} ENT {1; 1; 2} CfoTot : returns 5,000

4.10.6 Transpose

trans(matrix)

Returns a table/matrix in which each cell is swapped with the corresponding cell.

Data Types: table, matrix

Category: matrix

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  trans([[1; 2]; [3; 4]]) : returns [[1; 3]; [2; 4]]

- RPN Input Mode

  [[1; 2]; [3; 4]] trans : returns [[1; 3]; [2; 4]]

4.10.7 Uniform Series Future Value

usfv(percent; periods)

Returns the future value of a series of $1.00 payments. This function is only available if p1 Finance Lib is installed.

- **percent:** interest rate per compounding period expressed as a percentage.
- **periods:** number of payments.

Category: finance

Input Modes: algebraic, RPN

Examples:

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- Algebraic Input Mode

  usfv(5; 360) : returns 849,527,908.17

  usfv(5/12; 360) : returns 832.26

  usfv(8; 0) : returns 0

  usfv(0; 144) : returns 144

- RPN Input Mode

  5 ENT 360 usfv : returns 20.00

  5 ENT 360 usfv : returns 849,527,908.17

4.10.8 Uniform Series Present Value

uspv(percent; periods)

Returns the present value of a series of $1.00 payments. This function is only available if p1 Finance Lib is installed.

- **percent:** interest rate per compounding period expressed as a percentage.
- **periods:** number of payments.

Category: finance

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  uspv(5; 360) : returns 20.00

  uspv(5/12; 360) : returns 186.28

  uspv(8; 0) : returns 0

  uspv(0; 144) : returns 144

- RPN Input Mode

  5 ENT 360 uspv : returns 20.00

4.10.9 Variance

var(datalist [; occlist])

Returns the sample variance of the list datalist. occlist is an optional argument that can contain a list of occurences corresponding to the values in datalist.

- **datalist:** a list containing values used in the calculation.
- **occlist:** a list, the same size as datalist, containing the number of occurrences of each corresponding value in datalist. occlist is optional for algebraic input mode but required for RPN input mode. Note that if occlist is not provided for functions that take occlist as an optional argument, the function treats each entry in datalist as a single occurrence.

Data Types: table, matrix

Category: stats

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

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var({1; 2; 3; 4; 5}) : returns 2.5

var({1; 2; 3; 4; 5}; {2; 4; 4; 6; 6}) : returns 1.7835

- RPN Input Mode

  {1; 2; 3; 4; 5} ENT 1 var : returns 2.5

  {1; 2; 3; 4; 5} ENT {2; 4; 4; 6; 6} var : returns 1.7835

varP(datalist [;occlist])

Returns the population variance of the list datalist. occlist is an optional argument that can contain a list of occurences corresponding to the values in datalist.

- **datalist:** a list containing values used in the calculation.
- **occlist:** a list, the same size as datalist, containing the number of occurrences of each corresponding value in datalist. occlist is optional for algebraic input mode but required for RPN input mode. Note that if occlist is not provided for functions that take occlist as an optional argument, the function treats each entry in datalist as a single occurrence.

Data Types: table, matrix

Category: stats

Input Modes: algebraic, RPN

Examples:

- Algebraic Input Mode

  varP({1; 2; 3; 4; 5}) : returns 2

  varP({1; 2; 3; 4; 5}; {2; 4; 4; 6; 6}) : returns 1.7025

- RPN Input Mode

  {1; 2; 3; 4; 5} ENT 1 varP : returns 2

  {1; 2; 3; 4; 5} ENT {2; 4; 4; 6; 6} varP : returns 1.7025

5 Graphing

5.1 Accessing

There are four ways to access graphing:

- In the main calculator, select the Graph button at the top of the screen to go to My Graphs. See the Using the Calculator : Interface Overview section for more on this button.
- In the main calculator, select "powerOne" then select "My Graphs".
- Select the "Graph" or similar button at the bottom of a template. Some templates offer graphing while others do not. See the Templates section for more information.
- Some third-party software applications offer single touch graphing from within their applications. This may be available as a button on the screen or as a menu option. See your third-party software application's manual for more information.

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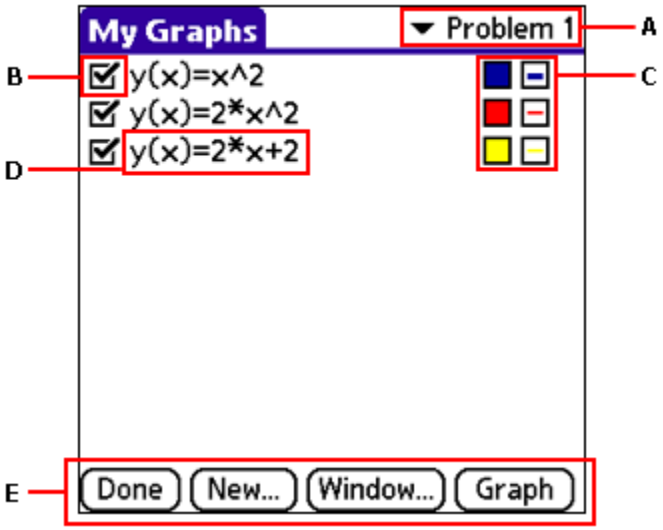
5.2 My Graphs

My Graphs is the central location for graphing. It shows a list of all created graphs, plus offers navigation to create new graphs, set the window coordinates and graph the selected equations/data sets. See Graphing : Accessing for more on accessing My Graphs.



A. Category: graphs are organized into categories. When graphing, only the selected equations within that category will be graphed. To change categories, select the label and choose one from the list. To create a new one or edit existing ones, select "Edit Categories". Note that the "Unfiled" and " Templates" categories cannot be deleted ("Templates" is used as the category for graphing from templates). To create a category, select "New" and enter a name. To rename or delete a category, select the category name then the appropriate button. There is no restriction on the number of categories that can be created.

B. Checkbox: check all graphs that should be graphed.

C. Color/Pattern: select the color and line pattern for equations. (On black and white devices, the color selector doesn't appear).

D. Equation/Data: displays the equation or data set. If a name is designated, the name will display instead. Select this for a list of options:

- Quick Graph: graph the selected equation/data set only.
- Edit: edit the selected equation/data set. See the New Graph section for more information.
- Delete: delete the selected equation/data set.
- Export/Beam: show export and beam options for the selected equation/data set. See Sharing Graphs for more information.
- Duplicate: make a copy of the selected equation/data set.
- Table: display a table for the selected equation. Table is not available for data sets. For data sets, edit and select the appropriate data item.
- Copy to Macro: save a copy of the graph as a macro for use in the main calculator. Only available for function graphs.
- Notes: display notes pertaining to the selected equation/data set.

E. Buttons: select the "Done" button to return to the previous display. Select the "New" button to create a new graph. See the New/Edit Graphs section for more information. Select "Window" to set the graph window coordinates. See the Window Settings section for more information. Select "Graph" to graph the selected equations/data sets. See the Graph section for more information.

F. Menus: select "Import" to see import options. Select "Export/Beam Category" to export/beam options. See Sharing Graphs for more information on import and export/beam. Select "Delete Category" to delete the category and all equations/data sets in the current category.

5.3 New/Edit Graphs

New/Edit Graphs is where equations and data sets are prepared for graphing. Access New/Edit Graphs by selecting "New" at the bottom of My Graphs or by selecting "Go" then "New Graph" in the graph window.

Tabs

There are three areas designated by tabs:

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- Data: used to enter data and equations. Also used to set line and/or data point color and pattern. Color is available only on color devices.
- Details: details about the graph, including name and category.
- Prefs: graph preferences and range settings. Preferences and range are set for individual equations/data sets instead of for the entire graph window. This offers more flexibility in graphing multiple graph types (functions, polar, parametric, data plots, etc.) in the same graph window.

Appearance and functionality for each graph type is listed below.

Keypad

The keypad is available for entering function, polar, parametric and sequence graphs. While similar to the keypad in the main calculator, there are a few differences. "f(x)" displays the list of functions organized by category. This is the same as the main calculator's list except category MEM is added (memory store, recall and clear options). The variables 'x', 't', 'n', 'u', 'v', and 'w' are in single quotes to designate that they are variables and to differentiate variable 'x' from multiply.

Menus

There are two menus available.

The Edit menu:

- Undo: shortcut U, undo the last cut/copy/paste or entry in the field.
- Cut: shortcut X, cut the selected text to the clipboard.
- Copy: shortcut C, copy the selected text to the clipboard.
- Paste: shortcut P, paste the selected text from the clipboard to the entry line.
- Select All: shortcut S, selects all text in the entry line.
- Keyboard: shortcut K, displays the Palm OS keyboard for data entry.
- Graffiti Help: shortcut G, help with Graffiti keystrokes.

The Options menu:

- Preferences: display preferences for My Graphs. When a new graph is created, the graph type selector appears automatically. To keep this from appearing, uncheck the box.

5.3.1 Function

This section describes New/Edit Graphs layout for function graphs. Function graphs are those that define dependent variable y in terms of independent variable x.

Data Tab

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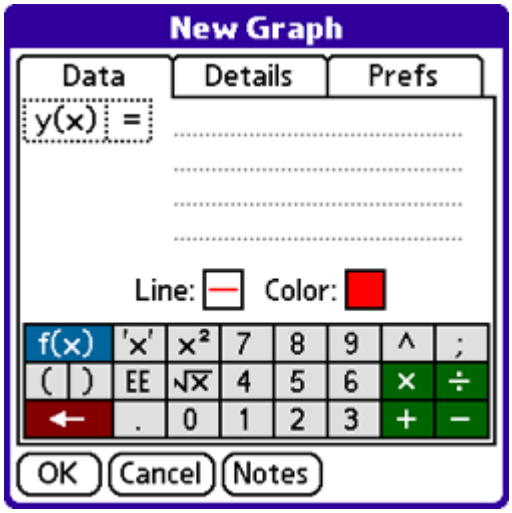
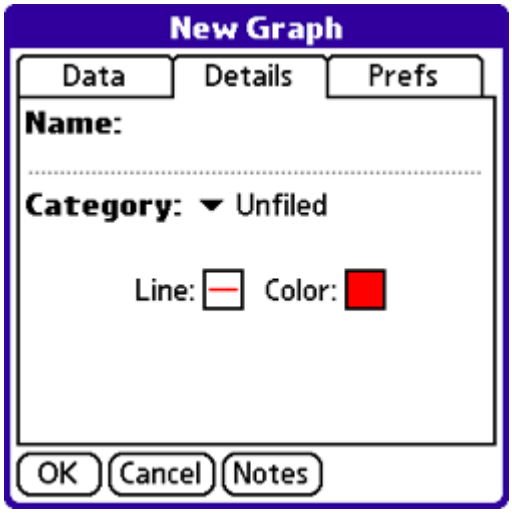
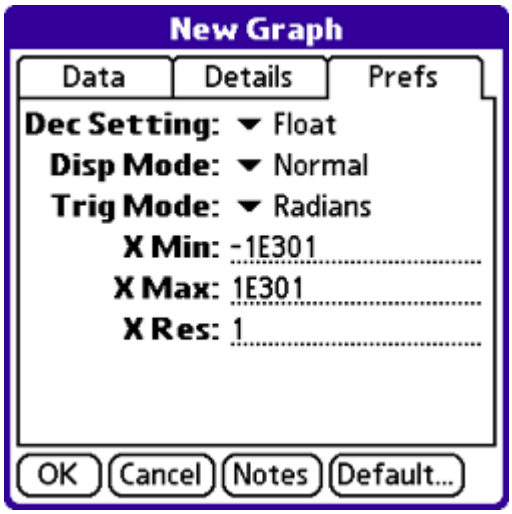


- **y(x):** select to change graph types.
- **Inequalities:** select "=" to change how inequalities are drawn. To draw only the curve, select "=". To shade the region above or below the graph including the curve, select ">=" or "<=", respectively. To shade the region above or below the graph without drawing the curve, select ">" or "<", respectively.
- **Entry Line:** enter the function equation. Use the keypad to speed entry. See the Graphing : New/Edit Graphs section for more on the keypad.
- **Line:** choose a line pattern for the curve. From left to right, solid single line, dots, dashes, dash-dot, and double solid line are available (some devices may only offer solid single line, dots, and double solid line).
- **Color:** choose a color for the line and shading. On black and white devices where color is not available, the line is drawn in black and shading for inequalities is handled automatically.
- **Buttons:** select "OK" to save changes and "Cancel" to delete changes and leave New/Edit Graph. Select "Notes" to add notes about the graph.



Details Tab

- **Name:** enter a name for the graph. This is optional. If the graph has a name, the name will be displayed instead of the equation in My Graphs. If a graph is named, this name can be used in other function graphs. See Graphing : Examples : Graph Names for more on graph names.
- **Category:** choose a category for this graph.
- **Line:** same as Line in the Data Tab.
- **Color:** same as Color in the Data Tab.
- **Buttons:** same as Buttons in the Data Tab.



Prefs Tab

- **Dec Setting:** number of decimal places to display when using the analysis functions. Float shows all available decimal places. 0 through 11 shows that many decimal places. With very large numbers, fewer decimal places may be displayed because of the total number of places available to show.
- **Disp Mode:** display numbers in normal, scientific or engineering notation when using the analysis functions. Normal mode displays numbers as would normally be written on paper or, if the number is too large or too small to display all places, in scientific notation. Scientific mode displays numbers in 3.45e67 format. The number of places displayed after the decimal point is determined by the decimal setting. Engineering mode uses the decimal setting to determine a number of displayed significant digits and then adjusts the exponent to be a multiple of 3. The number of significant digits is 1 plus the decimal setting.

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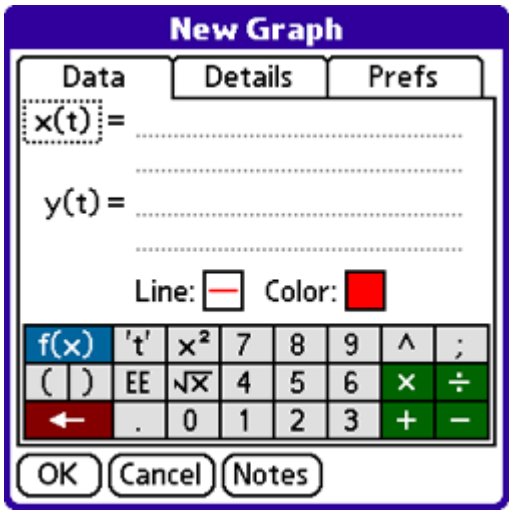
- **Trig Mode:** calculate trigonometric functions as either degrees or radians.
- **X Min:** the starting value of x for the function graph. To graph all available points, set to -1E301.
- **X Max:** the ending value of x for the function graph. To graph all available points, set to 1E301.
- **X Res:** how many points are plotted: 1 plots every point, 2 plots every other point, etc.
- **Buttons:** same as Buttons in the Data Tab except "Default", which resets the preferences to their original settings.

5.3.2 Parametric

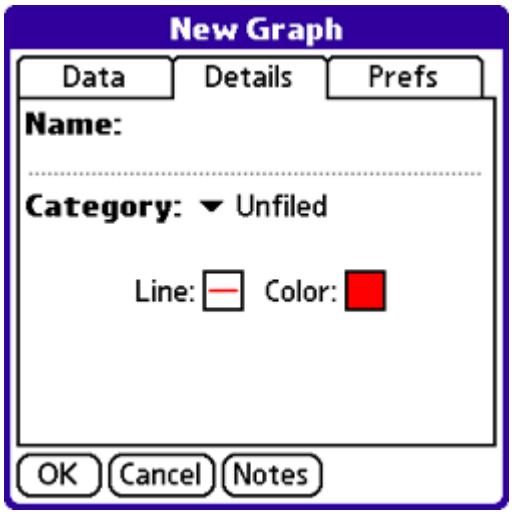
This section describes New/Edit Graphs layout for parametric graphs. Parametric graphs are those that define dependent variables x and y based on a third independent variable t.

Data Tab



- **x(t):** select to change graph types.
- **Entry Lines:** enter the parametric equations with x(t) and y(t) on their respective lines. Use the keypad to speed entry. See the Graphing : New/Edit Graphs section for more on the keypad.
- **Line:** choose a line pattern for the curve. From left to right, solid single line, dots, dashes, dash-dot, and double solid line are available (some devices may only offer solid single line, dots, and double solid line).
- **Color:** choose a color for the line. On black and white devices where color is not available the line is drawn in black.
- **Buttons:** select "OK" to save changes and "Cancel" to delete changes and leave New/Edit Graph. Select "Notes" to add notes about the graph.

Details Tab



- **Name:** enter a name for the graph. This is optional. If the graph has a name, the name will be displayed instead of the equation in My Graphs.
- **Category:** choose a category for this graph.
- **Line:** same as Line in the Data Tab.
- **Color:** same as Color in the Data Tab.
- **Buttons:** same as Buttons in the Data Tab.

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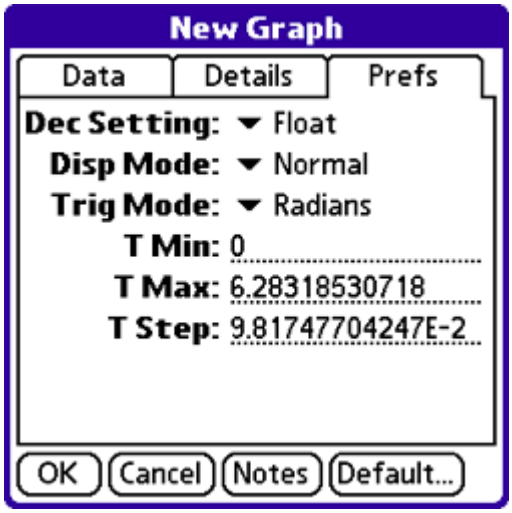
Prefs Tab

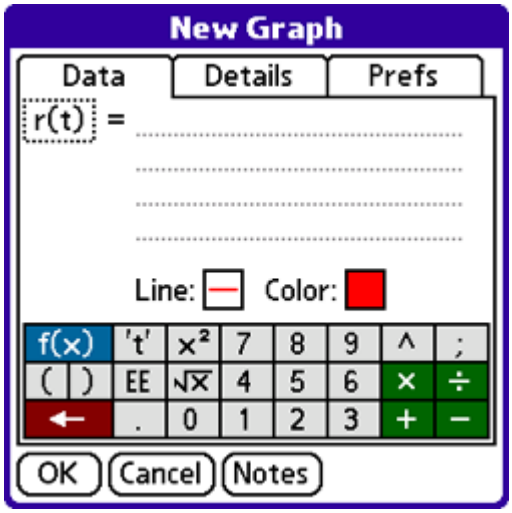


- **Dec Setting:** number of decimal places to display when using the analysis functions. Float shows all available decimal places. 0 through 11 shows that many decimal places. With very large numbers, fewer decimal places may be displayed because of the total number of places available to show.
- **Disp Mode:** display numbers in normal, scientific or engineering notation when using the analysis functions. Normal mode displays numbers as would normally be written on paper or, if the number is too large or too small to display all places, in scientific notation. Scientific mode displays numbers in 3.45e67 format. The number of places displayed after the decimal point is determined by the decimal setting. Engineering mode uses the decimal setting to determine a number of displayed significant digits and then adjusts the exponent to be a multiple of 3. The number of significant digits is 1 plus the decimal setting.
- **Trig Mode:** calculate trigonometric functions as either degrees or radians.
- **T Min:** starting value of t for the parametric graph.
- **T Max:** ending value of t for the parametric graph.
- **T Step:** the amount by which t increments when calculating each x,y point for the parametric graph.
- **Buttons:** same as Buttons in the Data Tab except "Default", which resets the preferences to their original settings.

5.3.3 Polar

This section describes New/Edit Graphs layout for polar graphs. Polar graphs are those that define dependent variable r (radius) in terms of independent variable t (theta or angle).

Data Tab



- **r(t):** select to change graph types.
- **Entry Lines:** enter the polar equation on the line. Use the keypad to speed entry. See the Graphing : New/Edit Graphs section for more on the keypad.
- **Line:** choose a line pattern for the curve. From left to right, solid single line, dots, dashes, dash-dot, and double solid line are available (some devices may only offer solid single line, dots, and double solid line).
- **Color:** choose a color for the line. On black and white devices where color is not available the line is drawn in black.
- **Buttons:** select "OK" to save changes and "Cancel" to delete changes and leave New/Edit Graph. Select "Notes" to add notes about the graph.

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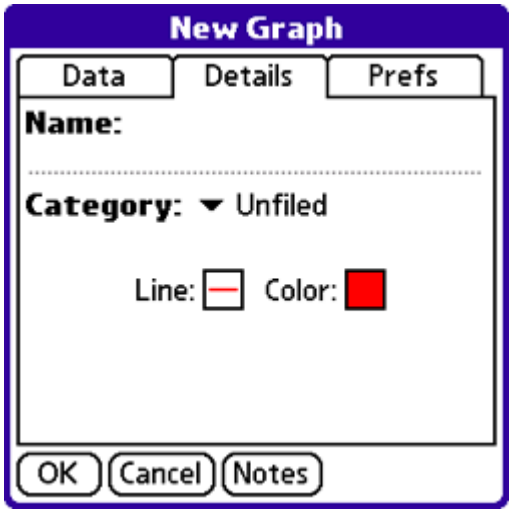
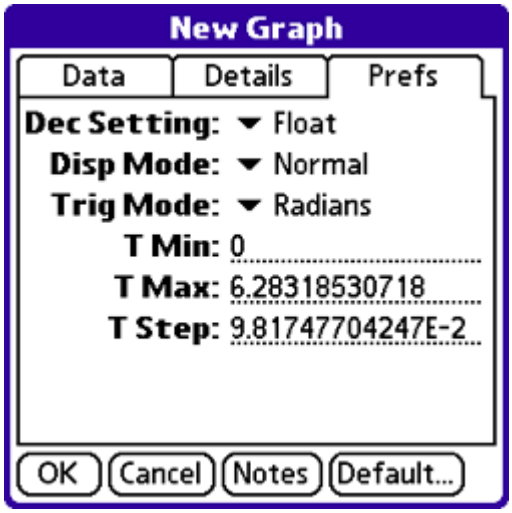


Details Tab

- **Name:** enter a name for the graph. This is optional. If the graph has a name, the name will be displayed instead of the equation in My Graphs. If a graph is named, this name can be used in other polar graphs. See Graphing : Examples : Graph Names for more on graph names.
- **Category:** choose a category for this graph.
- **Line:** same as Line in the Data Tab.
- **Color:** same as Color in the Data Tab.
- **Buttons:** same as Buttons in the Data Tab.



Prefs Tab

- **Dec Setting:** number of decimal places to display when using the analysis functions. Float shows all available decimal places. 0 through 11 shows that many decimal places. With very large numbers, fewer decimal places may be displayed because of the total number of places available to show.
- **Disp Mode:** display numbers in normal, scientific or engineering notation when using the analysis functions. Normal mode displays numbers as would normally be written on paper or, if the number is too large or too small to display all places, in scientific notation. Scientific mode displays numbers in 3.45e67 format. The number of places displayed after the decimal point is determined by the decimal setting. Engineering mode uses the decimal setting to determine a number of displayed significant digits and then adjusts the exponent to be a multiple of 3. The number of significant digits is 1 plus the decimal setting.
- **Trig Mode:** calculate trigonometric functions as either degrees or radians.
- **T Min:** starting value of t for the polar graph.
- **T Max:** ending value of t for the polar graph.
- **T Step:** the amount by which t is incremented when calculating each x,y point for the polar graph.
- **Buttons:** same as Buttons in the Data Tab except "Default", which resets the preferences to their original settings.

5.3.4 Sequence

This section describes New/Edit Graphs layout for sequence graphs. Sequence graphs are those that define dependent variables u, v and w in sequential relation to independent variable n.

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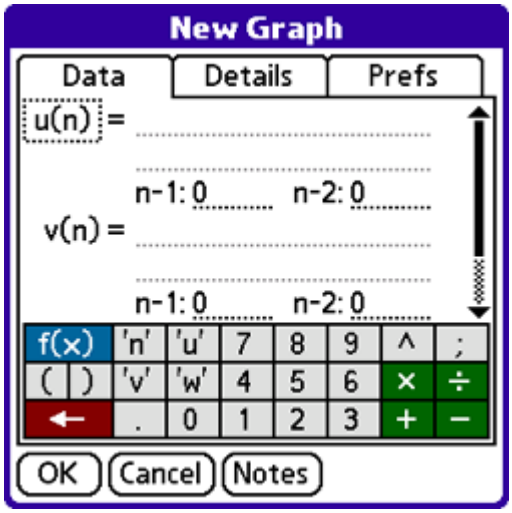
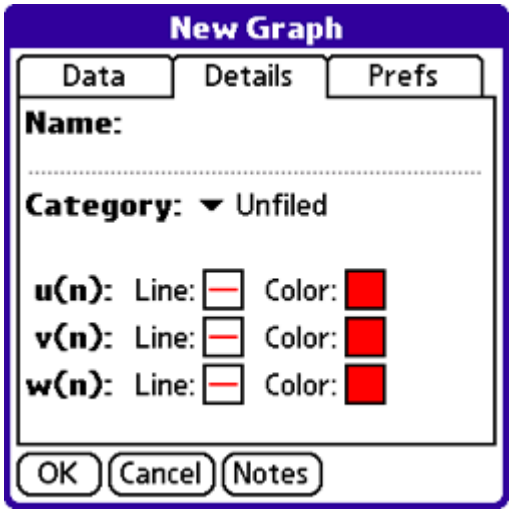
Data Tab



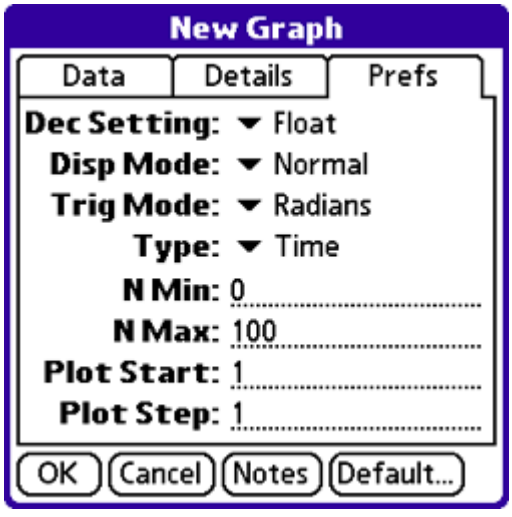
- **u(n):** select to change graph types.
- **Entry Lines:** enter the sequence equations (3 are available: u, v, and w) and first and second previous terms as required for each. Scroll to see w(n). n is the independent variable for each equation (u, v and w). n-1 is the previous value for n and n-2 is the previous before the previous value for n-1. Previous values are designated for recursive sequences only. Use the keypad to speed entry. See the Graphing : New/Edit Graphs section for more on the keypad.
- **Buttons:** select "OK" to save changes and "Cancel" to delete changes and leave New/Edit Graph. Select "Notes" to add notes about the graph.

Details Tab



- **Name:** enter a name for the graph. This is optional. If the graph has a name, the name will be displayed instead of the equation in My Graphs.
- **Category:** choose a category for this graph.
- **Line:** choose a line pattern for each of the curves. From left to right, solid single line, dots, dashes, dash-dot, and double solid line are available (some devices may only offer solid single line, dots, and double solid line).
- **Color:** choose a color for each of the lines. On black and white devices where color is not available the line is drawn in black.
- **Buttons:** same as Buttons in the Data Tab.

Prefs Tab



- **Dec Setting:** number of decimal places to display when using the analysis functions. Float shows all available decimal places. 0 through 11 shows that many decimal places. With very large numbers, fewer decimal places may be displayed because of the total number of places available to show.
- **Disp Mode:** display numbers in normal, scientific or engineering notation when using the analysis functions. Normal mode displays numbers as would normally be written on paper or, if the number is too large or too small to display all places, in scientific notation. Scientific mode displays numbers in 3.45e67 format. The number of places displayed after the decimal point is determined by the decimal setting. Engineering mode uses the decimal setting to determine a number of displayed significant digits and then adjusts the exponent to be a multiple of 3. The number of significant digits is 1 plus the decimal setting.
- **Trig Mode:** calculate trigonometric functions as either degrees or radians.
- **Type:** type of plot, each defined as follows:

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type	x-axis	y-axis
Time	n	u(n), v(n), w(n)
Web	u(n-1), v(n-1), w(n-1)	u(n), v(n), w(n)
uv	u(n)	v(n)
vw	v(n)	w(n)
uw	u(n)	w(n)

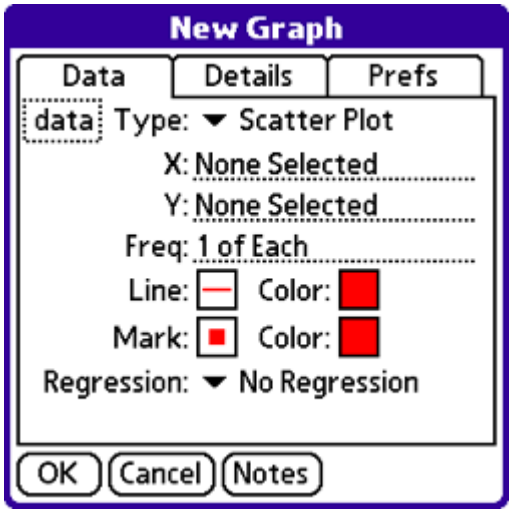
- **N Min:** minimum value of n to evaluate.
- **N Max:** maximum value of n to evaluate.
- **Plot Start:** first term to be plotted.
- **Plot Step:** controls how many points are plotted: 1 plots every point, 2 plots every other point, etc.
- **Buttons:** same as Buttons in the Data Tab except "Default", which resets the preferences to their original settings.

5.3.5 Data

This section describes New/Edit Graphs layout for data graphs. Data graphs plot individual data points in a table.

Data Tab

- **data:** select to change graph types.
- **Type:** six different types of data graphs are available: scatter plots, bar graphs, histograms, box plots, modified box plots and normal probability plots:
  - **Scatter Plot:** draws (x; y) data points given two-variable data. Row 1 of List X and row 1 of List Y are combined to make point (x1; y1) and on through the lists. These lists must be the same length and can be drawn with or without a line connecting the data points (choose Line: Dots to draw without a connecting line). A regression model can also be designated. If List X or List Y are "None Selected", it will assume a list in ascending order starting at 1 (i.e., 1,2,3,4,5, etc.).
  - **Bar Graph:** draws one-variable data in bar form. When drawn, x is the data number while y is the height or size of the data. Bar graph data is drawn in the same order as the data is recorded. It is possible to designate a frequency list, if desired. If no frequency list is designated, 1 of each data point will be assumed.



  - **Histogram:** draw one-variable data in bar form. When drawn, x is the bin number and y is the number of data points that fit within that bin. See the Preferences tab to set the number of bins or bin size, and the minimum bin number. It is possible to designate a frequency list, if desired. If no frequency list is designated, 1 of each data point will be assumed. Points on the edge of a bar are counted in the bar to the right.
  - **Box Plot:** draws one variable data, analyzing the median and quartile points. The box is Q1, median, Q3 from left to right, with whiskers extending from the minimum point to Q1 and Q3 to the maximum point. It is possible to designate a frequency list, if desired. If no frequency list is designated, 1 of each data point will be assumed. Box plots are drawn from top to bottom as displayed in My Graphs.
  - **Modified Box Plot:** draws one variable data the same as box plot, but ignores outlier data points. These points are drawn separately. Outlying data points are determined by taking 1.5 times the difference between Q3 and Q1. These are considered x points unless the point is the minimum or maximum point, then it is labeled as such. If the x point is not a minimum or a maximum, then the whisker is labeled as x instead. It is possible to designate a frequency list, if desired. If no frequency list is designated, 1 of each data point will be assumed. Modified box

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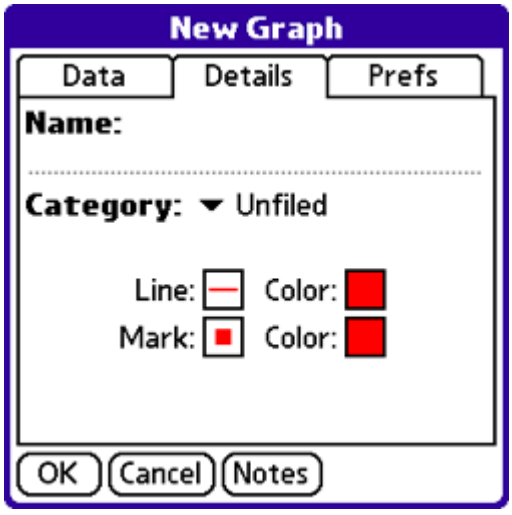
plots are drawn from top to bottom as displayed in My Graphs.

- **Normal Probability:** draws (x; y) data points given one-variable data. When drawn, the first data point is taken from the data list and the second point is found from the first standard normal distribution, or z quantile. Choose Data Axis 'X' to draw the (x; y) points as (data list point; z). Choose Data Axis 'Y' to draw the (x; y) points as (z; data list point). Data is considered normal when it is plotted close to a straight line.

- **X:** used with all data graphs but normal probability plots. Select to choose a list for the x data. Select an existing table and column or create a new one by selecting that option from the table list. To see the currently selected table, choose the 'Edit' button.
- **Data List:** used with normal probability plots. Select to choose a data list. Select an existing table and column or create a new one by selecting that option from the table list. To see the currently selected table, choose the 'Edit' button.
- **Y:** used with scatter plots. Select to choose a list for Y data. Select an existing table and column or create a new one by selecting that option from the table list. To see the currently selected table, choose the 'Edit' button. There must be the same total number of Y data points as X data points.
- **Freq:** used with one and two variable data plots excluding normal probability. Select to choose a frequency list. Frequency always defaults to '1 of Each', meaning each data point in the data list has one point with no accompanying frequency amount. Select an existing table and column or create a new one by selecting that option from the table list. To see the currently selected table, choose the 'Edit' button. There must be the same total number of Freq data points as X data points.
- **Data Axis:** used with normal probability plots. Select to designate whether the data list is drawn on the X or Y axis. See normal probability above for more information.
- **Line:** choose a line pattern for the plot. From left to right, solid single line, dots, dashes, dash-dot, and double solid line are available (some devices may only offer solid single line, dots, and double solid line). Note that some data graphs ignore the line choice.
- **Mark:** choose a data point mark pattern for the plot. From left to right, circle, large solid box, large hollow box, small solid box, cross hairs. Note that some data graphs ignore the mark choice.
- **Color:** choose a color for the line and mark. On black and white devices where color is not available, the line and mark are drawn in black.
- **Buttons:** select "OK" to save changes and "Cancel" to delete changes and leave New/Edit Graph. Select "Notes" to add notes about the graph.
- **Regression:** used with scatter plots. Select to draw a regression model along with the plot. Choose 'No Regression' to draw only the scatter plot. See Templates : Included Templates : Regressions for more information on each regression model.



Details Tab

- **Name:** enter a name for the graph. This is optional. If the graph has a name, the name will be displayed instead of the equation in My Graphs.
- **Category:** choose a category for this graph.
- **Line:** same as Line in the Data Tab.
- **Mark:** same as Mark in the Data Tab.
- **Color:** same as Color in the Data Tab.
- **Buttons:** same as Buttons in the Data Tab.

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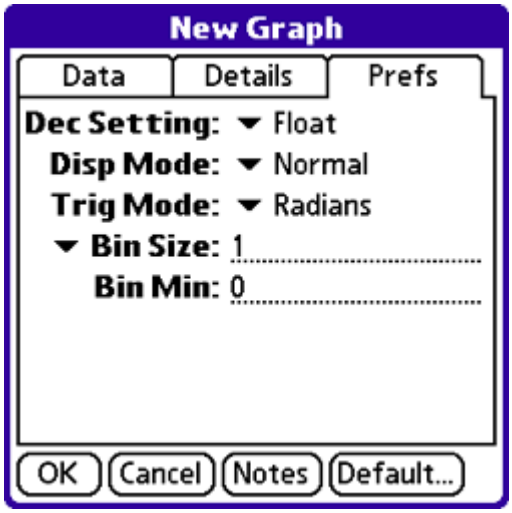
Prefs Tab



- **Dec Setting:** number of decimal places to display when using the analysis functions. Float shows all available decimal places. 0 through 11 shows that many decimal places. With very large numbers, fewer decimal places may be displayed because of the total number of places available to show.
- **Disp Mode:** display numbers in normal, scientific or engineering notation when using the analysis functions. Normal mode displays numbers as would normally be written on paper or, if the number is too large or too small to display all places, in scientific notation. Scientific mode displays numbers in 3.45e67 format. The number of places displayed after the decimal point is determined by the decimal setting. Engineering mode uses the decimal setting to determine a number of displayed significant digits and then adjusts the exponent to be a multiple of 3. The number of significant digits is 1 plus the decimal setting.

- **Dec Setting:** number of decimal places to display when using the analysis functions. Float shows all available decimal places. 0 through 11 shows that many decimal places. With very large numbers, fewer decimal places may be displayed because of the total number of places available to show.
- **Disp Mode:** display numbers in normal, scientific or engineering notation when using the analysis functions. Normal mode displays numbers as would normally be written on paper or, if the number is too large or too small to display all places, in scientific notation. Scientific mode displays numbers in 3.45e67 format. The number of places displayed after the decimal point is determined by the decimal setting. Engineering mode uses the decimal setting to determine a number of displayed significant digits and then adjusts the exponent to be a multiple of 3. The number of significant digits is 1 plus the decimal setting.
- **Trig Mode:** calculate trigonometric functions as either degrees or radians.
- **Bin Size/#Bins:** available for histograms only, bin size designates the size of each individual bin while number of bins (#Bins) designates the total number of bins to split the data. To switch between Bin Size and #Bins, select the label and choose one from the list. Examples 1: with the option set to Bin Size, a setting of 10 with Bin Min set to 0 means numbers 0 through 9 are in one bin, 10 through 19 in the next, and so on. Example 2: with the option set to #Bins, a setting of 10 when the largest point is 130, the smallest is 20 and the Bin Min is 20 means there will be 10 total bins each with a size of 11. Example 3: with the option set to #Bins, the same data set as Example 2 and Bin Min set to 0 means there will be 10 total bins each with a size of 13.
- **Bin Min:** available for histograms only, bin minimum designates the starting point for the bins. Data less than the starting point is ignored. Example: class grades were from 65% to 95% but 0-65% grades need to be displayed. In this case, setting Bin Size to 10 and Bin Min to 0 shows this additional information.
- **Buttons:** same as Buttons in the Data Tab except "Default", which resets the preferences to their original settings.

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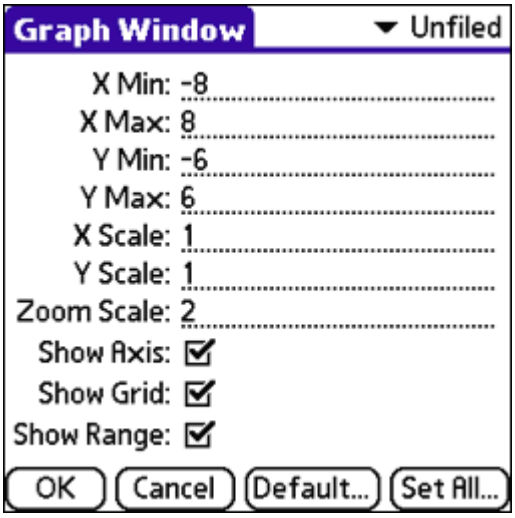
5.4 Window Settings

Use Window Settings to set the coordinate and axis data for the Graph Display.



- **Category:** graphs are organized into categories. When graphing, only the selected equations within that category will be graphed, using that category's window settings. Changing window settings affects only the currently visible category. To change categories, select the label in the top, right-hand corner and choose a new one from the list.
- **X Min:** minimum on the x-axis (horizontal, far left edge of the graph window).
- **X Max:** maximum on the x-axis (horizontal, far right edge of the graph window).
- **Y Min:** minimum on the y-axis (vertical, bottom edge of the graph window). When in an analysis mode, the bottom 12.5% is clipped, however Y Min setting remains the same.
- **Y Max:** maximum on the y-axis (vertical, top edge of the graph window). When in an analysis mode, the top 12.5% is clipped, however Y Max setting remains the same.
- **X Scale:** determines the tick intervals on the x-axis.
- **Y Scale:** determines the tick intervals on the y-axis.
- **Zoom Scale:** ratio to jump when zooming in or out. A setting of 2 means 2 times.
- **Show Axis:** check this box to show the axis. See Graphing: Graph Display for a picture.
- **Show Grid:** check this box to show the grid. See Graphing: Graph Display for a picture.
- **Show Range:** check this box to show the range values. See for a picture.
- **Buttons:** select "OK" to save changes and "Cancel" to delete changes and leave Window Settings. Select "Default" to reset the currently visible category's window settings to its default values (as shown above). Select "Set All" to set all categories window settings to the currently visible category's settings.

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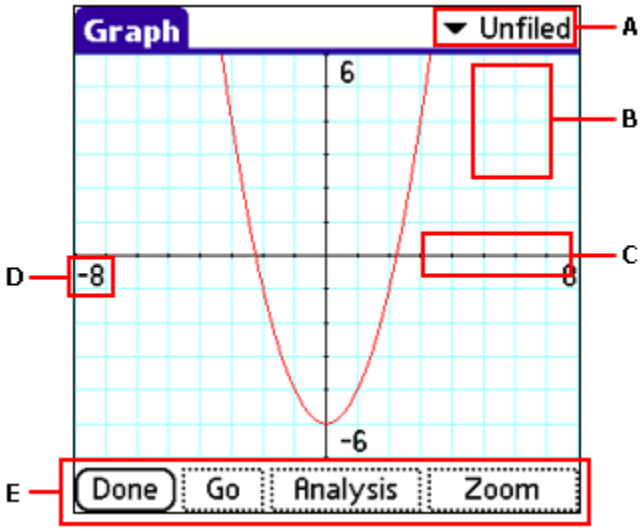
5.5 Graph Display

Graph Display is where graphs are drawn and analyzed.

A. Category: graphs are organized into categories. When graphing, only the selected equations within that category will be graphed. To change categories, select the label and choose one from the list. Note that the "Unfiled" and "Templates" categories cannot be deleted ("Templates" is used as the category for graphing from templates). To rename or delete a category, select the category name then the appropriate button. There is no restriction on the number of categories that can be created.

B. Grid: grid pattern. On color devices, it appears the same as in the picture above. On black and white, the grid is individual black data points. To turn on/off the grid, see Graphing : Window Settings.

C. Axis: axis designates the where x is 0 and y is 0. The x-axis is horizontal while the y-axis is vertical. To turn on/off the axis, see the Graphing : Window Settings section.



D. Range: min and max data points along the x axis and y axis. To turn on/off the axis, see the Graphing : Window Settings section.

E. Buttons: select the "Done" button to return to the previous display. Select the "Go" button to create a new graph, go to My Graphs, or go to Window Settings. Select "Analysis" to perform analysis on the graph. See the Analysis Modes section for more information. Select "Zoom" to quickly change the window settings. See the Zooming section for more information.

F. Menus: select "About powerOne" for information about the product.

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5.5.1 Analysis Modes

There are 14 analysis modes for analyzing graphs. This chart provides a brief overview:

Type	Selection*	Function	Parametric	Polar	Sequence	Plotting
Hide	None	x	x	x	x	x
Trace/Eval	Drag	x	x	x	x	x
Y Intercept	None	x				
Roots	Box	x				
Intersection	Box	x**				
Derivative	Drag	x	x	x		
Integral	Box	x				
Inflection	Box	x				
Minimum	Box	x				
Maximum	Box	x				
Distance	Points	x				
Arc	Points	x				
Tangent	Drag	x				
Regression	None					x***
Crop	Box					x

* Selection describes how to select the information to analyze:
- None: no selection required.
- Drag: when analyzing function graphs, click down on the graph and drag the cursor. For other graph types, use the on-screen scroll arrows to move left or right.
- Points: click down on the display to select the first point, drag to the second point and release.
- Box: click down in the top, left-hand corner, drag to the lower, right-hand corner, and release.

** Available when two or more function equations are drawn.

*** Regression curves are function graphs. When a regression curve is drawn, all function analysis modes are also available.

Each analysis mode is as follows:

- **Hide:** hides the analysis area.
- **Trace/Eval:** traces and evaluates the graph. This mode displays the coordinates for the current cursor location. With function graphs, tap down on the screen and drag the cursor. With other graph types, use the on-screen left and right arrows to trace the graph. Select the "x", "t" or "n" variable and enter in a new value to evaluate a given point.
- **Y Intercept:** displays the value for y when x is 0. This point is automatically displayed.
- **Roots:** finds the value for x when y is 0. Draw a box on the screen where the equation crosses the x-axis. Draw a box by clicking in the top, left-hand corner, dragging to the lower, right-hand corner and releasing.
- **Intersection:** finds the intersection of two equations (only available when more than one function graph is drawn). Draw a box around the intersecting area to find the data point. Draw a box by clicking in the top, left-hand corner,

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dragging to the lower, right-hand corner and releasing.

- **Derivative:** calculates the derivative of the selected point. It is in the following forms: dy/dx (first) and d2y/d2x (second) for function graphs, dy/dx, dy/dt and dx/dt for parametric graphs, and dy/dx and dr/dt for polar graphs. With function graphs, tap down on the screen and drag the cursor. With other graph types, use the on-screen left and right arrows to trace the graph. Select the "x" or "t" variable and enter in a new value to evaluate a given point.
- **Integral:** calculates the integral based on an upper (u) and lower (l) boundary. Enter the boundaries manually or by selecting the two points on the display. Choose the two points by selecting down on the first point, dragging the cursor to the second point and releasing. Calculate by selecting the "Integral" button.
- **Inflection:** finds the inflection point (where the second derivative is 0). Draw a box around the portion of the display to analyze. Draw a box by clicking in the top, left-hand corner, dragging to the lower, right-hand corner and releasing.
- **Minimum:** finds the minimum point of the equation. Draw a box around the portion of the display to analyze. Draw a box by clicking in the top, left-hand corner, dragging to the lower, right-hand corner and releasing.
- **Maximum:** finds the maximum point of the equation. Draw a box around the portion of the display to analyze. Draw a box by clicking in the top, left-hand corner, dragging to the lower, right-hand corner and releasing.
- **Distance:** finds the straight-line distance between two points. Enter the points manually or by selecting the two points on the display. Choose the two points by selecting down on the first point, dragging the cursor to the second point and releasing.
- **Arc:** finds the distance along the curve between two points. Enter the points manually or by selecting the two points on the display. Choose the two points by selecting down on the first point, dragging the cursor to the second point and releasing. Calculate by selecting the "Arc" button.
- **Tangent:** displays a tangent line and evaluates the slope (m) and y-intercept (b) at that point. Tap down on the screen and drag the cursor or select the "x" variable and enter in a new value to evaluate a given point.
- **Regression:** displays a selected regression model. Change models by selecting the regression equation. Select the magnification icon to see additional information regarding the regression and the disc button to save the regression as its own function graph. The regression model saves with the selected data when exiting the regression mode window. See the Included Templates : Regression section for more information on each of the models.
- **Crop:** provides a method for the data to be cropped. Draw a box around the data points to keep or remove, then select either the "Keep Selected" or "Remove Selected" button. The data will be copied to a new table with "_crop" appended to the end of the name and a new data plot will be created. The new data plot will also be redrawn on the display. The original data is not modified.

5.5.2 Zooming

There are 9 zoom modes for moving around the graph:

- **Default:** returns to the default window setting.
- **Previous:** returns to the previous window setting.
- **Center:** repositions the screen so the selected point becomes the center of the display. Select a point in the graph window to reposition.
- **In:** zooms in on the selected point on the screen. Zoom In zooms "Zoom Scale" times as set in the Window Settings. Select a point in the graph window to reposition. See the Graphing : Window Settings section for more on Zoom Scale.
- **Out:** zooms out on the selected point on the screen. Zoom Out zooms "Zoom Scale" times as set in the Window settings screen. Select a point in the graph window to reposition. See the Graphing : Window Settings section for more on Zoom Scale.
- **Box:** zooms to the specified area of the display. Draw a box by clicking in the top, left-hand corner, dragging to the lower, right-hand corner and releasing.
- **Square:** attempts to adjust the x and y maximum and minimum so the change of x is the same as the change of y.

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- **Best Fit:** calculates the best fit and changes the window coordinates appropriately. Best Fit takes all graphs into consideration.
- **Stats:** calculates the best fit for data graphs only, changing the window coordinates appropriately. This zoom mode ignores other graphs drawn at the same time, focusing only on the data graph.

5.6 Examples

This section includes graph examples. From time to time, Infinity Softworks posts supplemental materials on its web site. Check product support at www.infinitysw.com/graph for additional examples.

5.6.1 Function

The Example

This is an example to show basic features of function graphing. This example uses the equation y = 2*x^2. What is covered:

- Create a function graph
- Trace the curve
- Evaluate a point on the curve
- Zoom in on the graph
- Zoom a specific area with Box Zoom
- Move around the graph with Zoom Center

Other items discussed (briefs):

- Table of data
- Inequalities
- Family of curves

Create a New Graph

1. Launch the software. The main calculator should be visible.

2. Select the Graph button or choose "powerOne" then "My Graphs". The Graph button is second from the left across the top of the main calculator. My Graphs should be visible.

3. Select "New" from the bottom of My Graphs. New Graph should be visible.

4. Select "Function" from the pop-up list.

5. Enter "2 * x ^ 2" (without quotation marks) on the entry line. On the keypad, enter [2] [x] ['x'] [x^2].
   - multiplication symbol is in the lower, right-hand corner to the left of divide.
   - 'x' is in the top, left-hand corner of the keypad, next to f(x).
   - x^2 is to the right of 'x'.

6. (No other graph information needs to be entered at this time.)

7. Select "OK" at the bottom of the screen to save the graph. My Graphs should be visible.

Graph the Equation

8. Only those graphs with checkmarks are graphed. Make sure only "y(x) = 2*x^2" is checked.

9. Select the "Graph" button at the bottom of My Graphs. The Graph display should be visible with the parabola drawn on the screen.

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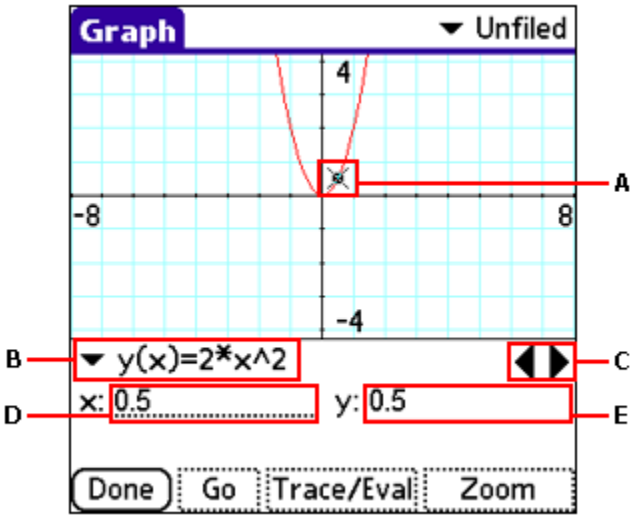
Trace and Evaluate

10. Select "Analysis" at bottom of the Graph display.

11. Choose "Trace/Eval" from the list.
    - 25% of the screen is clipped to accommodate the analysis area, 12.5% at each the top and bottom.
    - "Trace/Eval" displays instead of "Analysis" on the button.
    - cross hairs [A in the picture] draw at the currently evaluated point.
    - the current equation [B] is displayed. This is the equation being analyzed. If there is more than one equation drawn at the same time, choose the equation and select another graph to analyze.
    - the 'x' value [D] and 'y' value [E] show the point designated by the cross hair's location.



12. To trace, drag the cross hairs to another location or choose the left and right scroll arrows [C].

13. To evaluate, select 0 next to 'x' [D], enter 1 in the pop-up calculator, and select the checkmark to save.
    - when underlined, values can be changed (like 'x'). When not underlined, the value can be selected but it cannot be changed (like 'y').
    - the cross hairs [A] move to the new evaluated position.
    - 'y' [E] is the analyzed value and (x, y) matches the same point as the cross hairs. In this case, y is 2.

Adjust the Display with Zoom In

14. Select "Zoom" at the bottom of the Graph display.

15. Choose "Zoom In". The Zoom buttons changes to Zoom In.

16. Select the point that will become the new center point. The new window is drawn, zooming in the number of times designated by Zoom Scale in Window Setting. See Graphing : Window Settings for more information.

Adjust the Display with Zoom Box

17. Select "Zoom In" at the bottom of the Graph display.

18. Choose "Zoom Box". The Zoom buttons changes to Zoom Box.

19. Draw a box around the new display area.
    - In the top, left-hand corner of the new area, click down on the screen.
    - Drag to the lower, right-hand corner of the new area.
    - Release. The window zooms in on that area.

Move Around the Display with Zoom Center

20. Select "Zoom Box" at the bottom of the Graph display.

21. Choose "Zoom Center". The Zoom buttons changes to Zoom Ctr.

22. Select the point that will become the new center point. The new window is drawn, re-positioning the display with the selected point at the center.

Briefs

A. Display a Table of Data: displays data points based on the selected equations.
- select "Done" in the Graph display. New Graph should be visible.
- select the desired equation.
- choose "Table" from the list. The table display should be visible.
- use the scroll arrows to move up or down.

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- change Start for a new starting point. For example, select Start's value, enter 2 in the pop-up calculator, and choose the checkmark to save.
- change Step to see more or less detail. For example, select Step's value, enter .001 in the pop-up calculator, and choose the checkmark to save.

B. Inequalities: alters the graph to include shading.

- select "Done" in the Table display. My Graphs should be visible.
- select the desired equation.
- choose "Edit" from the list. Edit Graph should be visible.
- select "=" and choose ">=" from the list.
- select "OK" in Edit Graph. New Graph should be visible.
- only those graphs with checkmarks are graphed. Make sure only "y(x) >= 2*x^2" is checked.
- select "Graph" at the bottom of My Graphs. The Graph display should be visible with the shaded parabola drawn on the screen.

C. Family of Curves: families of curves are used to explore differences between equations when a single variable is altered. To graph a family of curves, use a table as one of the variables in the equation:

- select "Done" in the Graph display. My Graphs should be visible.
- select the desired equation.
- choose "Edit" from the list. Edit Graph should be visible.
- alter the equation to read "{2;4;6}*x^2" (no quotes). Braces { } can be found by selecting f(x) then stats. Semi-colon is in the top, right-hand corner above divide.
- select ">=" and choose "=" from the list.
- select "OK" in Edit Graph. New Graph should be visible.
- only those graphs with checkmarks are graphed. Make sure only "y(x) >= {2;4;6}*x^2" is checked.
- select "Graph" at the bottom of My Graphs. The Graph display should be visible with the three parabolas drawn on the screen.

5.6.2 Parametric

The Example

This is an example to show basic features of parametric graphing. This example uses the equations x = cos(t) and y = sin(t). What is covered:

- Create a parametric graph
- Trace the curve

Other items discussed (briefs):

- Table of data
- Family of curves

Create a New Graph

1. Launch the software. The main calculator should be visible.

2. Select the Graph button or choose "powerOne" then "My Graphs". The Graph button is second from the left across the top of the main calculator. My Graphs should be visible.

3. Select "New" from the bottom of My Graphs. New Graph should be visible.

4. Select "Parametric" from the pop-up list.

5. Enter "cos(t)" (without quotation marks) on the entry line next to x(t). On the keypad, enter [cos] ['t'].
   - cos can be found by selecting f(x) then trig. The parentheses are added automatically.
   - 't' is in the top, left-hand corner of the keypad, to the right of f(x).

6. Enter "sin(t)" (without quotation marks) on the entry line next to y(t). On the keypad, enter [sin] ['t'].

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- sin can be found by selecting f(x) then trig. The parentheses are added automatically.
- 't' is in the top, left-hand corner of the keypad, to the right of f(x).

7. Select "OK" at the bottom of the screen to save the graph. My Graphs should be visible.

Graph the Equation

8. Only those graphs with checkmarks are graphed. Make sure only "x(t)=cos(t) y(t)=sin(t)" is checked.

9. Select the "Graph" button at the bottom of My Graphs. The Graph display should be visible with the curve drawn on the screen.

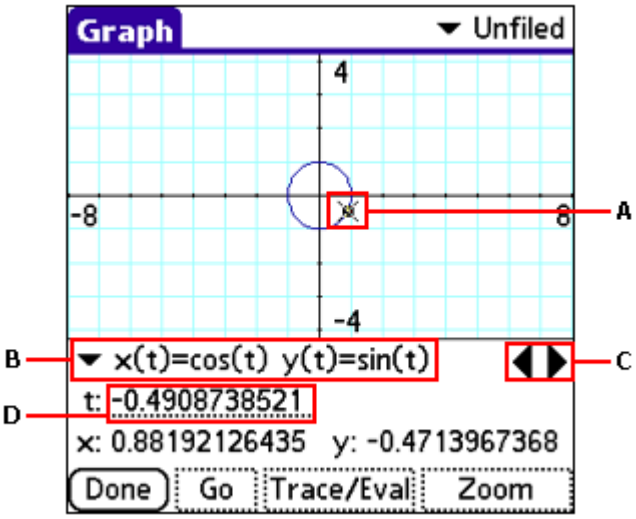
Trace

10. Select "Analysis" at bottom of the Graph display.

11. Choose "Trace/Eval" from the list.

- 25% of the screen is clipped to accommodate the analysis area, 12.5% at each the top and bottom.
- "Trace/Eval" displays instead of "Analysis" on the button.
- cross hairs [A in the picture] draw at the currently evaluated point.
- the current equation [B] is displayed. This is the equation being analyzed. If there is more than one equation drawn at the same time, choose the equation and select another graph to analyze.
- the 't' value [D] and 'x' and 'y' values default to the point designated by the cross hair's location.

13. To trace, choose the left and right scroll arrows [C].



Briefs

A. Display a Table of Data: displays data points based on the selected equations. The process is the same as the one described for function graphs. Please see the Examples : Function section for more information.

B. Family of Curves: family of curves is not available for parametric equations.

5.6.3 Polar

The Example

This is an example to show basic features of polar graphing. This example uses the equation r = .2*t. What is covered:

- Create a polar graph
- Evaluate a point on the curve
- Alter the curve

Other items discussed (briefs):

- Table of data
- Family of curves

Create a New Graph

1. Launch the software. The main calculator should be visible.

2. Select the Graph button or choose "powerOne" then "My Graphs". The Graph button is second from the left across the top of the main calculator. My Graphs should be visible.

3. Select "New" from the bottom of My Graphs. New Graph should be visible.

4. Select "Polar" from the pop-up list.

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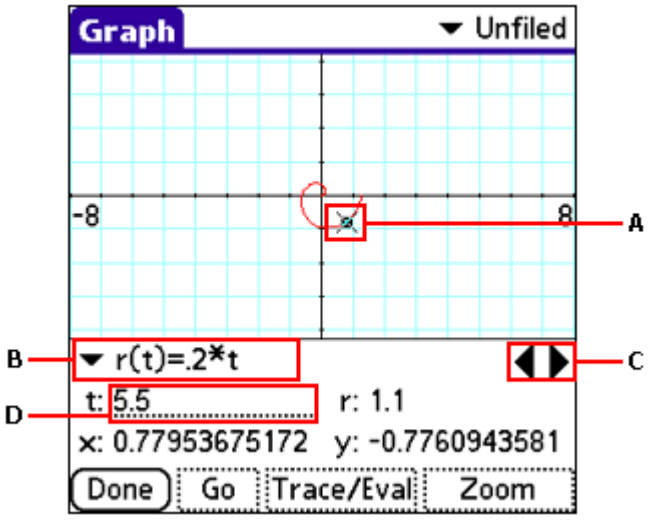
5. Enter ".2 * t" (without quotation marks) on the entry line. On the keypad, enter [.] [2] [x] ['t'].
   - decimal point (whether period or comma) is in the lower, left-hand corner to the right of backspace.
   - multiplication symbol is in the lower, right-hand corner to the left of divide.
   - 't' is in the top, left-hand corner of the keypad, next to f(x).
6. (No other graph information needs to be entered at this time.)
7. Select "OK" at the bottom of the screen to save the graph. My Graphs should be visible.

Graph the Equation

8. Only those graphs with checkmarks are graphed. Make sure only "r(t) = .2 * t" is checked.
9. Select the "Graph" button at the bottom of My Graphs. The Graph display should be visible with the curve drawn on the screen.

Evaluate

10. Select "Analysis" at bottom of the Graph display.
11. Choose "Trace/Eval" from the list.
    - 25% of the screen is clipped to accommodate the analysis area, 12.5% at each the top and bottom.
    - "Trace/Eval" displays instead of "Analysis" on the button.
    - cross hairs [A in the picture] draw at the currently evaluated point.
    - the current equation [B] is displayed. This is the equation being analyzed. If there is more than one equation drawn at the same time, choose the equation and select another graph to analyze.
    - the 't' value [D] and 'r', 'x' and 'y' values default to the point designated by the cross hair's location.



12. To evaluate, select 0 next to 't' [D], enter 5.5 in the pop-up calculator, and select the checkmark to save.
    - when underlined, values can be changed (like 't'). When not underlined, the value can be selected but it cannot be changed (like 'r', 'x' and 'y').
    - the cross hairs [A] move to the new evaluated position.
    - 'r', 'x' and 'y' are the analyzed values. (x, y) matches the same point as the cross hairs.

Alter the Graph

13. Select "Done" at the bottom of the Graph display. My Graphs should be visible.
14. Select the desired equation.
15. Select "Edit" from the list. Edit Graph should be visible.
16. Select the "Prefs" tab.
17. Change T Max to 20.
    - select the value next to T Max. The pop-up calculator should be visible.
    - enter 20 in the pop-up calculator.
    - select the checkmark button to save.
18. Select "OK" at the bottom of the screen to save the graph. My Graphs should be visible.

Graph the Equation Again

19. Only those graphs with checkmarks are graphed. Make sure only "r(t) = .2 * t" is checked.
20. Select the "Graph" button at the bottom of My Graphs. The Graph display should be visible with the curve drawn on

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the screen. Notice that the graph is larger than the first time it was plotted.

Briefs

A. Display a Table of Data: displays data points based on the selected equations. The process is the same as the one described for function graphs. Please see the Examples : Function section for more information.

B. Family of Curves: families of curves are used to explore differences between equations when a single variable is altered. To graph a family of curves, use a table as one of the variables in the equation. For the above example, graph "{.2; .4} * t" (no quotes). The process is the same as the one described for function graphs. Please see the Examples : Function section for more information.

5.6.4 Sequence

The Example

This is an example to show basic features of sequence graphing. This example uses the equation u = 2n over the range1 through 10. Since it is sequential, when n is 1, u is 2 (2 x 1), when n is 2, u is 4 and so on until n is 10 and u is 20. What is covered:

- Create a non-recursive sequence graph
- Change window settings manually
- Zoom using best fit
- Trace points on the curve

Other items discussed (briefs):

- Multiple equations in a sequence graph
- Recursive equations

Create a New Graph

1. Launch the software. The main calculator should be visible.

2. Select the Graph button or choose "powerOne" then "My Graphs". The Graph button is second from the left across the top of the main calculator. My Graphs should be visible.

3. Select "New" from the bottom of My Graphs. New Graph should be visible.

4. Select "Sequence" from the pop-up list.

5. Enter "2*n" (without quotation marks) on the u(n) entry line. On the keypad, enter [2] [x] ['n'].
   - multiplication symbol is in the lower, right-hand corner to the left of divide.
   - 'n' is in the top, left-hand corner of the keypad, next to f(x).

6. Select the "Prefs" tab at the top of the display and set N Min to 1 and N Max to 10.
   - to set N Min, select its value, enter 1 in the pop-up calculator, and select the checkmark to save.
   - to set N Max, select its value, enter 10 in the pop-up calculator, and select the checkmark to save.

7. Select the "Details" tab at the top of the display and set u(n) line to dot.
   - select the box next to Line on the u(n) row and choose dot (second from the left).
   - in this case, we want to look at the points instead of the line.

8. Select "OK" at the bottom of the screen to save the graph. My Graphs should be visible.

Change the Window Settings

9. Select "Window" from the bottom of My Graphs. Window Settings should be visible.

10. Select the Show Grid checkbox, leaving it unchecked. (This plot is difficult to see with the plot turned on.)

11. Select "OK" at the bottom of the screen to save the graph. My Graphs should be visible.

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Graph the Equation

12. Only those graphs with checkmarks are graphed. Make sure only "u(n) = 2*n" is checked.

13. Select the "Graph" button at the bottom of My Graphs. The Graph display should be visible with the data points drawn on the screen.

Adjust the Display

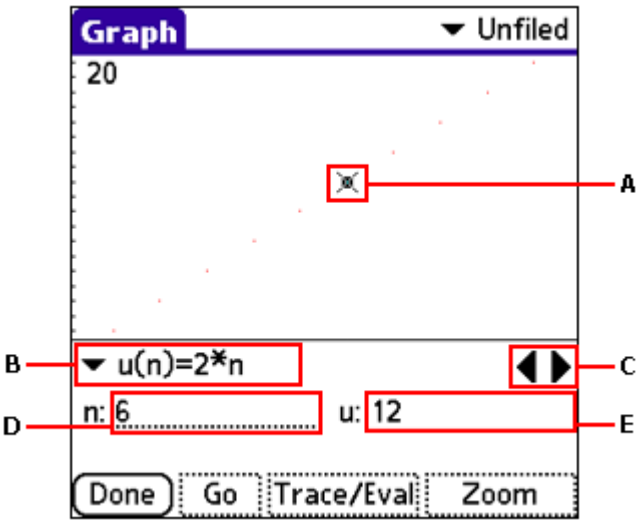
14. Select "Zoom" at the bottom of the Graph display.

15. Choose "Best Fit".
- the screen adjusts to show the plotted points.
- best fit repositions the graph so the appropriate data is visible.

Trace

16. Select "Analysis" at bottom of the Graph display.

17. Choose "Trace/Eval" from the list.
- 25% of the screen is clipped to accommodate the analysis area, 12.5% at each the top and bottom. When Zoom : Best Fit is chosen, the window is drawn to accommodate the clipped area.
- "Trace/Eval" displays instead of "Analysis" on the button.
- cross hairs [A in the picture] draw at the currently evaluated point, which in this case is shown as n = 6 [D].
- the current equation [B] is displayed. This is the equation being analyzed. If there is more than one equation drawn at the same time, choose the equation and select another graph to analyze. Equations u, v and w from the same sequence graph count as a single equation for evaluation purposes.
- the 'u' value [E] is evaluated. In this case u is 12. If v and/or w equations are also designated, those values will display as well.



18. To trace, choose the left and right scroll arrows [C].

Briefs

A. Multiple Equations in a Sequence Equation: useful for evaluating relationships between equations, whether those equations are dependent or independent of each other.
- go to My Graphs.
- select the desired graph [u(n) = 2*n]. A list of options should be visible.
- choose "Edit" from the list.
- enter "n/2" (without quotation marks) for v(n).
- choose the "Details" tab, select the box next to Line on the v(n) row and choose dot.
- select "OK" to return to My Graphs.
- only those graphs with checkmarks are graphed. Make sure only "u(n)=2*n v(n)=n/2" is checked.
- choose "Graph" at the bottom of My Graphs.
- choose "Zoom" then "Best Fit".
- choose "Analysis" then "Trace/Eval" to trace and evaluate the points in tandem.

B. Recursive Sequence Equations: recursive sequence equations rely on previous values to derive new ones. For example, graphing 2 *u(n-1) alters the graph by plotting 2 times the previous value of u(n).
- go to My Graphs.
- select "New" at the bottom of My Graphs.
- enter "2 * u(n-1)" (no quotes) on the u(n) entry line.

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- set n-1 to 1. This is giving the first instance of 2*u(n-1) a starting point.
- choose the "Prefs" tab and change N Min to 1 and N Max to 5.
- select "OK" to return to My Graphs.
- only those graphs with checkmarks are graphed. Make sure only "u(n)=2*u(n-1)" is checked.
- choose "Graph at the bottom of My Graphs.
- choose "Zoom" then "Best Fit".
- choose "Analysis" then "Trace/Eval" to trace and evaluate the points in tandem. Notice how the new u(n) value is derived based on the preceding u(n) value (when n is 3, u is 4 and when n is 4, u is 8 (previous u times 2).

5.6.5 Scatter Plot

The Example

This is an example to show basic features of scatter plot graphing. This example uses the following table:

#	1	2
1	1.1	0.9
2	1.7	1.5
3	2.3	2.5
4	3.1	3.2

What is covered:

- Create a table
- Create a scatter plot graph
- Zoom using best fit
- Trace data points
- Find the regression model

Create a New Table

1. Launch the software. The main calculator should be visible.

2. Select the Data button or choose "powerOne" then "My Data". The Data button is first to the left across the top of the main calculator. My Data should be visible.

3. Select "New" from the bottom of My Data.

4. Choose "Table" from the list.

5. Create the new table.
   - for the name, enter gamma.
   - for the number of rows, enter 4.
   - for the number of columns, enter 2.

6. Select "OK". The table editor should be visible.

7. Enter the table as displayed above.
   - select the cell at row 1, column 1.
   - enter 1.1 into the pop-up calculator.
   - select the check mark button to save.
   - move to the next cell and repeat with each cell's data until the entire table is entered.

8. When finished, select "OK" to save. My Data should be visible.

9. Select "Done" in My Data. The main calculator should be visible.

Create a New Graph

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10. Select the Graph button or choose "powerOne" then "My Graphs". The Graph button is second from the left across the top of the main calculator. My Graphs should be visible.

11. Select "New" from the bottom of My Graphs. New Graph should be visible.

12. Select "Data" from the pop-up list.

13. Type should be "Scatter Plot". If not, select the type label and select "Scatter Plot" from the list.

14. Select "None Selected" next to X. Select Table will display.

15. Choose the table and column for the X data.
- select None Selected and choose table gamma from the list.
- column 1 should be selected automatically.
- select "OK" to return to New Graph.

16. Select "None Selected" next to Y. Select Table will display.

17. Choose the table and column for the Y data.
- select None Selected and choose table gamma from the list.
- select column 1 and choose 2 from the list.
- select "OK" to return to New Graph.

18. Change line to dots.
- select the box next to Line and choose dot (second from the left).
- in this case, we want to look at the points instead of the line.

19. Select "OK" at the bottom of New Graph. My Graphs should be visible.

Graph the Equation

20. Only those graphs with check marks are graphed. Make sure only "X: gamma Col Y:gamma C" is checked.

21. Select the "Graph" button at the bottom of My Graphs. The Graph display should be visible with the data points drawn on the screen.

Adjust the Display

22. Select "Zoom" at the bottom of the Graph display.

23. Choose "Best Fit".
- the screen adjusts to show the plotted points.
- best fit repositions the graph so the appropriate data is visible.

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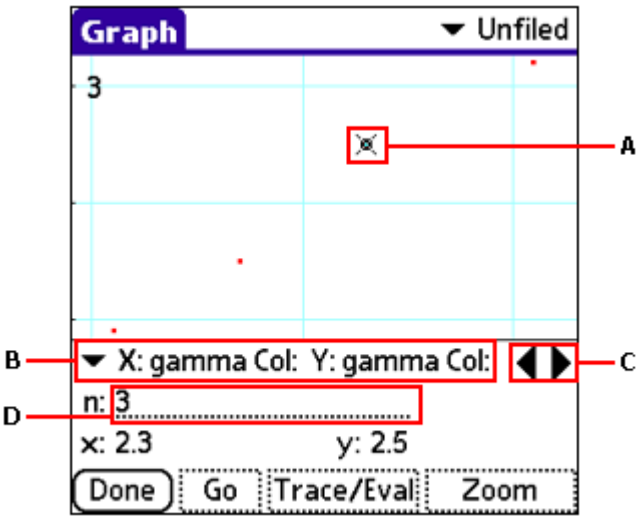
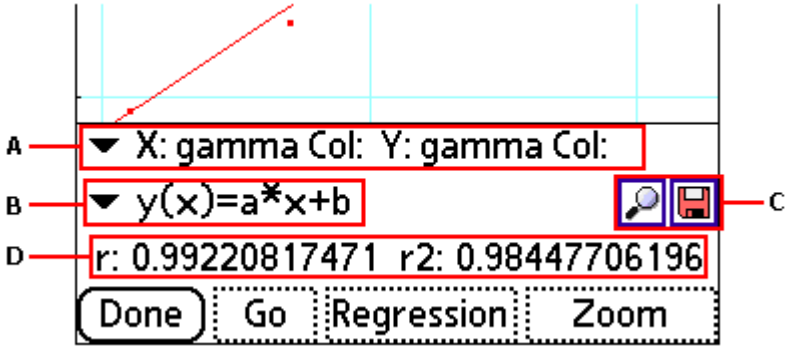
Trace



24. Select "Analysis" at the bottom of the Graph display.
25. Choose "Trace/Eval" from the list.
    - 25% of the screen is clipped to accommodate the analysis area, 12.5% at each the top and bottom. When Zoom : Best Fit is chosen, the window is drawn to accommodate the clipped area.
    - "Trace/Eval" displays instead of "Analysis" on the button.
    - cross hairs [A in the picture] draw at the currently evaluated point, which in this case is shown as n = 3 [D].
    - the current data graph [B] is displayed. This is the data graph being analyzed. If there is more than one data set drawn at the same time, choose the data graph and select another graph to analyze.
    - the 'n' value is the list index current being viewed
    - the 'o' value is only present when a frequency list is provided for scatter plots. It shows the number of occurrences for the 'x' and 'y' pair.
    - the 'x' value and 'y' value both default to the point designated by the cross hair's location.
26. To trace, choose the left and right scroll arrows [C].

Regression Models

27. Select "Trace/Eval" at the bottom of the Graph display.
28. Choose "Regression" from the list.
29. Select "No Regression".
30. Choose "Linear" from the list.
    - the regression curve is drawn with the data points.
    - the current data graph is displayed [A in the picture]. This is the data graph being analyzed. If there is more than one data set drawn at the same time, choose the data graph and select another graph to analyze.



    - the regression equation is displayed [B]. To change the regression model, select the equation and choose a new model.
    - in most cases, curve fit information (r and r2) is displayed [D].
    - to see additional regression curve information, select the magnifying glass [C, on the left].
    - to save the regression curve as its own function graph, select the disc [C, on the right].
    - the regression curve, once designated, automatically saves with the data graph. To hide the regression curve, select the regression equation [B] and choose "No Regression" from the list.

5.6.6 Histogram

The Example

This is an example to show basic features of histogram graphing. This example uses the following table:

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#	1
1	85
2	75
3	90
4	95
5	95
6	60
7	75
8	80
9	75
10	75

What is covered:

- Create a table
- Create a histogram graph
- Zoom using best fit
- Trace data points

Other items discussed (briefs):

- Impact of number of bins

Create a New Table

1. Launch the software. The main calculator should be visible.

2. Select the Data button or choose "powerOne" then "My Data". The Data button is first to the left across the top of the main calculator. My Data should be visible.

3. Select "New" from the bottom of My Data.

4. Choose "Table" from the list.

5. Create the new table.
   - for the name, enter eta.
   - for the number of rows, enter 10.
   - for the number of columns, enter 1.

6. Select "OK". The table editor should be visible.

7. Enter the table as displayed above.
   - select the cell at row 1, column 1.
   - enter 85 into the pop-up calculator.
   - select the checkmark button to save.
   - move to the next cell and repeat with each cell's data until the entire table is entered.

8. When finished, select "OK" to save. My Data should be visible.

9. Select "Done" in My Data. The main calculator should be visible.

Create a New Graph

10. Select the Graph button or choose "powerOne" then "My Graphs". The Graph button is second from the left across the top of the main calculator. My Graphs should be visible.

11. Select "New" from the bottom of My Graphs. New Graph should be visible.

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12. Select "Data" from the pop-up list.

13. Select the Type label and choose "Histogram" from the list.

14. Select "None Selected" next to X. Select Table Column will display.

15. Choose the table and column for the X data.
    - select None Selected and choose table eta from the list.
    - column 1 should be selected automatically.
    - select "OK" to return to New Graph.

16. (Frequency will remain "1 of Each".)

17. Select the "Prefs" tab at the top of the display and set Bin Size to 10.
    - to set Bin Size, select its value, enter 10 in the pop-up calculator, and select the checkmark to save.
    - starting at Bin Min, this will split data into 10 unit large bins.

18. Set Bin Min to 60.
    - to set Bin Min, select its value, enter 60 in the pop-up calculator, and select the checkmark to save.
    - bin min is the minimum number for the bins to start.

19. Select "OK" at the bottom of New Graph. My Graphs should be visible.

Graph the Equation

20. Only those graphs with checkmarks are graphed. Make sure only "X: eta Col: 1 Freq: 1 of Each" is checked.

21. Select the "Graph" button at the bottom of My Graphs. The Graph display should be visible, but no data can be seen yet.

Adjust the Display

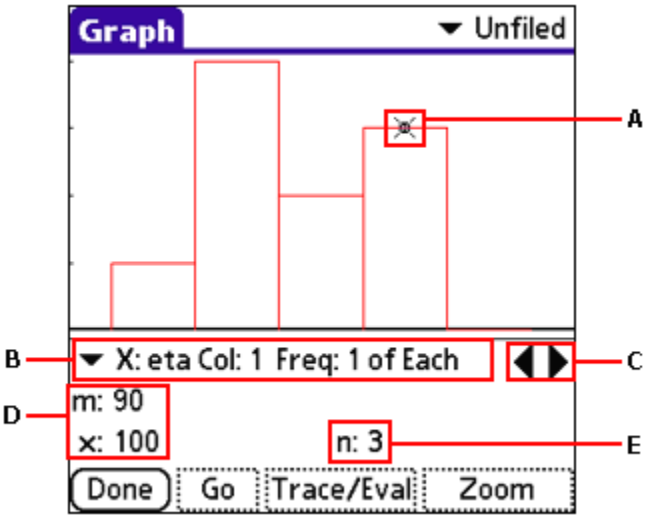
22. Select "Zoom" at the bottom of the Graph display.

23. Choose "Best Fit".
    - the screen adjusts to show the plotted points.
    - best fit repositions the graph so the appropriate data is visible.

Trace

24. Select "Analysis" at the bottom of the Graph display.

25. Choose "Trace/Eval" from the list.
    - 25% of the screen is clipped to accommodate the analysis area, 12.5% at each the top and bottom. When Zoom : Best Fit is chosen, the window is drawn to accommodate the clipped area.
    - "Trace/Eval" displays instead of "Analysis" on the button.
    - cross hairs [A in the picture] draw at the histogram bar being analyzed, which in this case is data points between the bin minimum 'm' and bin maximum 'x' (90 and 100) [D].
    - the current data graph [B] is displayed. This is the data graph being analyzed. If there is more than one data set drawn at the same time, choose the data graph and select another graph to analyze.
    - the number of items in the bin is n [E]. In this case, that is 3 items.



26. To trace, choose the left and right scroll arrows [C].

Briefs

A. Using Number of Bins: there are two ways to determine the bin size. The first is to designate the size, which is used

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in the example above. An alternative is to designate the total number of bins and split the data between them, as demonstrated here.

- go to My Graphs.
- select the desired graph [X: eta Col: 1 Freq: 1 of Each]. A list of options should be visible.
- choose "Edit" from the list.
- choose the "Prefs" tab
- select the label Bin Size and choose #Bins instead. This will split the data into 10 bins. Since the bin minimum is 60 and the maximum data point is 95, this means each bin's size will be (95 - 60) / 10 or 3.5 units. The first bin is 60 to 63.5, the second 63.5 to 67, and so on.
- select "OK" to return to My Graphs.
- only those graphs with checkmarks are graphed. Make sure only "X: eta Col: 1 Freq: 1 of Each" is checked.
- choose "Graph" at the bottom of My Graphs.
- choose "Zoom" then "Best Fit".
- choose "Analysis" then "Trace/Eval" to trace and evaluate the histogram.

5.6.7 Bar Graph

The Example

This is an example to show basic features of bar graphs. This example uses the same table as the histogram example. Please see that example to learn how to create a table.

What is covered:

- Create a bar graph
- Zoom using best fit
- Trace data points

Create a New Graph

1. Select the Graph button or choose "powerOne" then "My Graphs". The Graph button is second from the left across the top of the main calculator. My Graphs should be visible.

2. Select "New" from the bottom of My Graphs. New Graph should be visible.

3. Select "Data" from the pop-up list.

4. Select the Type label and choose "Bar" from the list.

5. Select "None Selected" next to X. Select Table Column will display.

6. Choose the table and column for the X data.
   - select None Selected and choose table eta from the list.
   - column 1 should be selected automatically.
   - select "OK" to return to New Graph.

7. (Frequency will remain "1 of Each".)

8. Select "OK" at the bottom of New Graph. My Graphs should be visible.

Graph the Equation

9. Only those graphs with checkmarks are graphed. Make sure only "X: eta Col: 1 Freq: 1 of Each" is checked.

10. Select the "Graph" button at the bottom of My Graphs. The Graph display should be visible, but no data can be seen yet.

Adjust the Display

22. Select "Zoom" at the bottom of the Graph display.

23. Choose "Best Fit".
   - the screen adjusts to show the plotted points.

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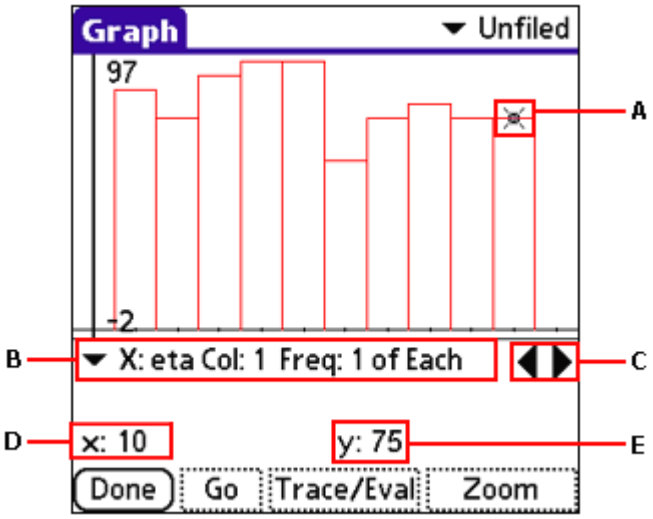
- best fit repositions the graph so the appropriate data is visible.

Trace

24. Select "Analysis" at the bottom of the Graph display.

25. Choose "Trace/Eval" from the list.
    - 25% of the screen is clipped to accommodate the analysis area, 12.5% at each the top and bottom. When Zoom : Best Fit is chosen, the window is drawn to accommodate the clipped area.
    - "Trace/Eval" displays instead of "Analysis" on the button.
    - cross hairs [A in the picture] draw at the bar being analyzed.
    - Bars are drawn in the same order they are entered in the table. The bar number is the 'x' data [D]. If a frequency table is used, each bar draws the frequency number of times before drawing the next bar. This means that the bar number will not match the table's row number.
    - The height of the bar is designated by 'y' [E].
    - the current data graph [B] is displayed. This is the data graph being analyzed. If there is more than one data set drawn at the same time, choose the data graph and select another graph to analyze.



26. To trace, choose the left and right scroll arrows [C].

5.6.8 Box Plot

The Example

This is an example to show basic features of box plot graphing. This example uses the following table:

#	1
1	20
2	25
3	28
4	27
5	26
6	29
7	31
8	28

What is covered:

- Create a table
- Create a box plot
- Zoom using best fit
- Trace data points

Create a New Table

1. Launch the software. The main calculator should be visible.

2. Select the Data button or choose "powerOne" then "My Data". The Data button is first to the left across the top of the

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main calculator. My Data should be visible.

3. Select "New" from the bottom of My Data.

4. Choose "Table" from the list.

5. Create the new table.
   - for the name, enter chi.
   - for the number of rows, enter 8.
   - for the number of columns, enter 1.

6. Select "OK". The table editor should be visible.

7. Enter the table as displayed above.
   - select the cell at row 1, column 1.
   - enter 20 into the pop-up calculator.
   - select the checkmark button to save.
   - move to the next cell and repeat with each cell's data until the entire table is entered.

8. When finished, select "OK" to save. My Data should be visible.

9. Select "Done" in My Data. The main calculator should be visible.

Create a New Graph

10. Select the Graph button or choose "powerOne" then "My Graphs". The Graph button is second from the left across the top of the main calculator. My Graphs should be visible.

11. Select "New" from the bottom of My Graphs. New Graph should be visible.

12. Select "Data" from the pop-up list.

13. Select the Type label and choose "Box Plot" from the list.

14. Select "None Selected" next to X. Select Table Column will display.

15. Choose the table and column for the X data.
   - select None Selected and choose table chi from the list.
   - column 1 should be selected automatically.
   - select "OK" to return to New Graph.

16. (Frequency will remain "1 of Each".)

17. Select "OK" at the bottom of New Graph. My Graphs should be visible.

Graph the Equation

18. Only those graphs with checkmarks are graphed. Make sure only "X: chi Col: 1 Freq: 1 of Each" is checked.

19. Select the "Graph" button at the bottom of My Graphs. The Graph display should be visible, but no data can be seen yet.

Adjust the Display

20. Select "Zoom" at the bottom of the Graph display.

21. Choose "Best Fit".
   - the screen adjusts to show the plotted points.
   - best fit repositions the graph so the appropriate data is visible.

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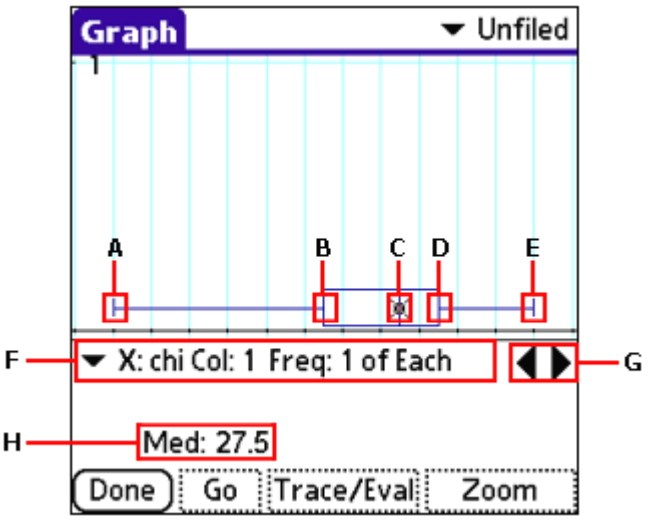
Trace

22. Select "Analysis" at the bottom of the Graph display.

23. Choose "Trace/Eval" from the list.
- 25% of the screen is clipped to accommodate the analysis area, 12.5% at each the top and bottom. When Zoom : Best Fit is chosen, the window is drawn to accommodate the clipped area.
- "Trace/Eval" displays instead of "Analysis" on the button.
- cross hairs [C in the picture] draws at the analyzed portion of the box plot. In this case, the cross hairs are at the median, which is 27.5 [H]. As the cross hairs move from left to right, the data is the minimum data point [A], first quartile [B], median [C], third quartile [D], and the maximum data point [E]. The calculation for finding the first and third quartiles uses Tukey's method, which includes the median. This may differ from other calculators.
- the current data graph [F] is displayed. This is the data graph being analyzed. If there is more than one data set drawn at the same time, choose the data graph and select another graph to analyze.



24. To trace, choose the left and right scroll arrows [G].

5.6.9 Modified Box Plot

The Example

This is an example to show basic features of modified box plot graphs. This example uses the same table as the box plot example. Please see that example to learn how to create a table.

What is covered:

- Create a box plot
- Zoom using best fit
- Trace data points

Create a New Graph

1. Select the Graph button or choose "powerOne" then "My Graphs". The Graph button is second from the left across the top of the main calculator. My Graphs should be visible.

2. Select "New" from the bottom of My Graphs. New Graph should be visible.

3. Select "Data" from the pop-up list.

4. Select the Type label and choose "Modified Box Plot" from the list.

5. Select "None Selected" next to X. Select Table Column will display.

6. Choose the table and column for the X data.
- select None Selected and choose table chi from the list.
- column 1 should be selected automatically.
- select "OK" to return to New Graph.

7. (Frequency will remain "1 of Each".)

8. Select "OK" at the bottom of New Graph. My Graphs should be visible.

Graph the Equation

18. Only those graphs with checkmarks are graphed. Make sure only "X: chi Col: 1 Freq: 1 of Each" is checked.

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19. Select the "Graph" button at the bottom of My Graphs. The Graph display should be visible, but no data can be seen yet.

Adjust the Display

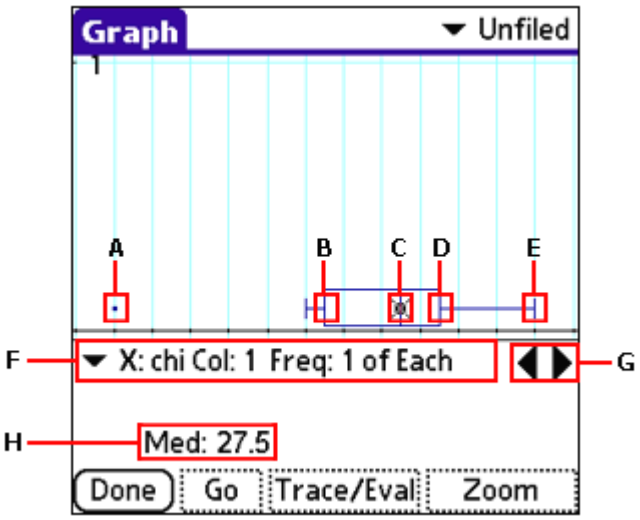
20. Select "Zoom" at the bottom of the Graph display.

21. Choose "Best Fit".
    - the screen adjusts to show the plotted points.
    - best fit repositions the graph so the appropriate data is visible.

Trace

22. Select "Analysis" at the bottom of the Graph display.

23. Choose "Trace/Eval" from the list.
    - 25% of the screen is clipped to accommodate the analysis area, 12.5% at each the top and bottom. When Zoom : Best Fit is chosen, the window is drawn to accommodate the clipped area.
    - "Trace/Eval" displays instead of "Analysis" on the button.
    - cross hairs [C in the picture] draws at the analyzed portion of the box plot. In this case, the cross hairs are at the median, which is 27.5 [H]. As the cross hairs move from left to right, the data is the minimum data point [A], x data point (no letter), first quartile [B], median [C], third quartile [D], and the maximum data point [E]. The minimum data point is an outlier data point so draws as a point instead. The calculation for finding the first and third quartiles uses Tukey's method, which includes the median. This may differ from other calculators.
    - the current data graph [F] is displayed. This is the data graph being analyzed. If there is more than one data set drawn at the same time, choose the data graph and select another graph to analyze.



24. To trace, choose the left and right scroll arrows [G].

5.6.10 Normal Probability Plot

The Example

This is an example to show basic features of normal probability graphing. This example uses the following table:

#	1
1	0.9
2	1.1
3	1.5
4	1.7
5	2.3
6	2.5
7	3.1
8	3.2

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What is covered:

- Create a table
- Create a normal probability graph
- Zoom using best fit
- Trace data points

Other items discussed (briefs):

- Changing the Axis

Create a New Table

1. Launch the software. The main calculator should be visible.

2. Select the Data button or choose "powerOne" then "My Data". The Data button is first to the left across the top of the main calculator. My Data should be visible.

3. Select "New" from the bottom of My Data.

4. Choose "Table" from the list.

5. Create the new table.
   - for the name, enter omicron.
   - for the number of rows, enter 8.
   - for the number of columns, enter 1.

6. Select "OK". The table editor should be visible.

7. Enter the table as displayed above.
   - select the cell at row 1, column 1.
   - enter 0.9 into the pop-up calculator.
   - select the checkmark button to save.
   - move to the next cell and repeat with each cell's data until the entire table is entered.

8. When finished, select "OK" to save. My Data should be visible.

9. Select "Done" in My Data. The main calculator should be visible.

Create a New Graph

10. Select the Graph button or choose "powerOne" then "My Graphs". The Graph button is second from the left across the top of the main calculator. My Graphs should be visible.

11. Select "New" from the bottom of My Graphs. New Graph should be visible.

12. Select "Data" from the pop-up list.

13. Select the Type label and choose "Normal Probability" from the list.

14. Select "None Selected" next to Data List. Select Table Column will display.

15. Choose the table and column for the X data.
   - select None Selected and choose table omicron from the list.
   - column 1 should be selected automatically.
   - select "OK" to return to New Graph.

16. Select "OK" at the bottom of New Graph. My Graphs should be visible.

Graph the Equation

17. Only those graphs with checkmarks are graphed. Make sure only "Data List: om Data Axis: X" is checked.

18. Select the "Graph" button at the bottom of My Graphs. The Graph display should be visible, but no data can be seen yet.

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Adjust the Display

19. Select "Zoom" at the bottom of the Graph display.

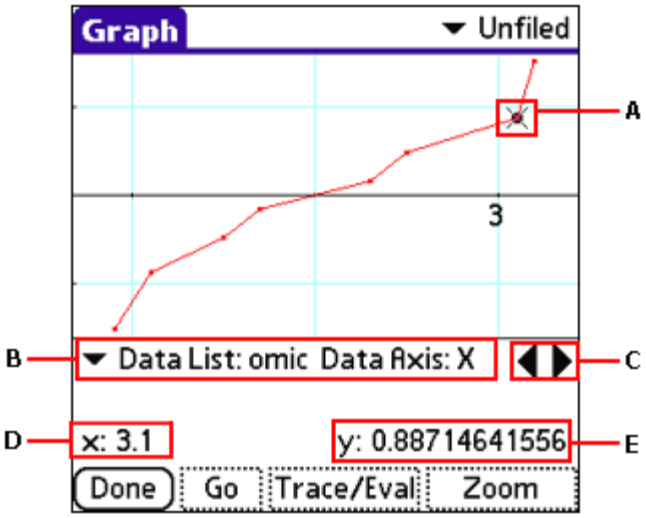
20. Choose "Best Fit".
    - the screen adjusts to show the plotted points.
    - best fit repositions the graph so the appropriate data is visible.

Trace

24. Select "Analysis" at the bottom of the Graph display.

25. Choose "Trace/Eval" from the list.
    - 25% of the screen is clipped to accommodate the analysis area, 12.5% at each the top and bottom. When Zoom : Best Fit is chosen, the window is drawn to accommodate the clipped area.
    - "Trace/Eval" displays instead of "Analysis" on the button.
    - cross hairs [A in the picture] draw at the data point being analyzed, which in this case is data point is (x, z quantile) [(D, E)].
    - the current data graph [B] is displayed. This is the data graph being analyzed. If there is more than one data set drawn at the same time, choose the data graph and select another graph to analyze.

26. To trace, choose the left and right scroll arrows [C].



Briefs

A. Using Data Axis: when plotted on the x axis, normal probability points are plotted at (x, z quantile) as in the example above. X is a data point in the list while z quantile is the normal probability of that x. An alternative is to draw on the y axis, or (z quantile, y) where y is a data point in the list and z quantile is the normal probability of that y. The second alternative is demonstrated here.

- go to My Graphs.
- select the desired graph [Data List: om Data Axis: X]. A list of options should be visible.
- choose "Edit" from the list.
- select "Y" for Data Axis instead.
- select "OK" to return to My Graphs.
- only those graphs with checkmarks are graphed. Make sure only "Data List: om Data Axis: Y" is checked.
- choose "Graph" at the bottom of My Graphs.
- choose "Zoom" then "Best Fit".
- choose "Analysis" then "Trace/Eval" to trace and evaluate the histogram.

5.6.11 Graph Names

Graphs that are named can be used to build equations in other graphs of the same type. This feature only works with polar and function graphs.

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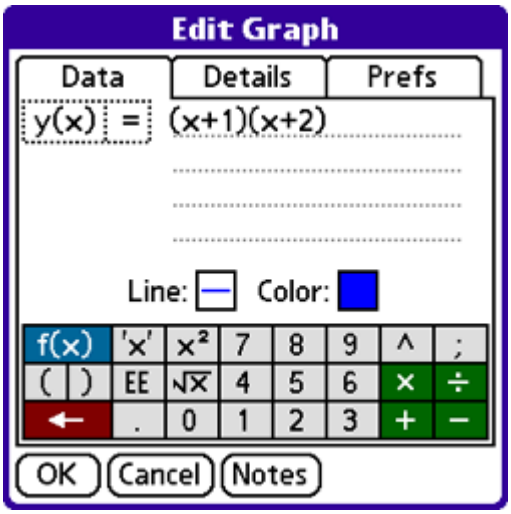
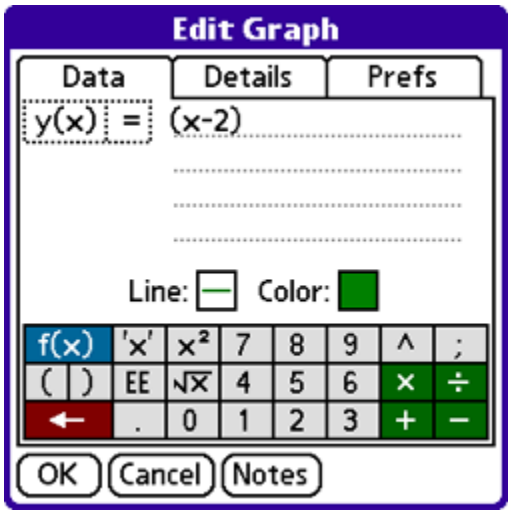
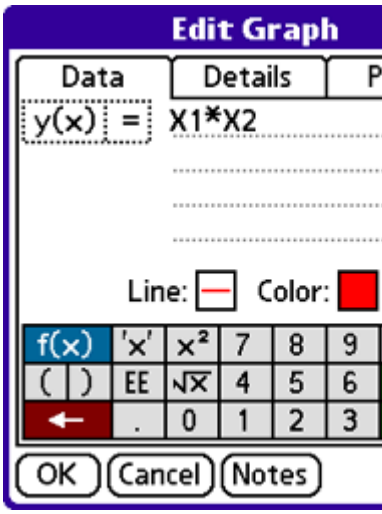
X1



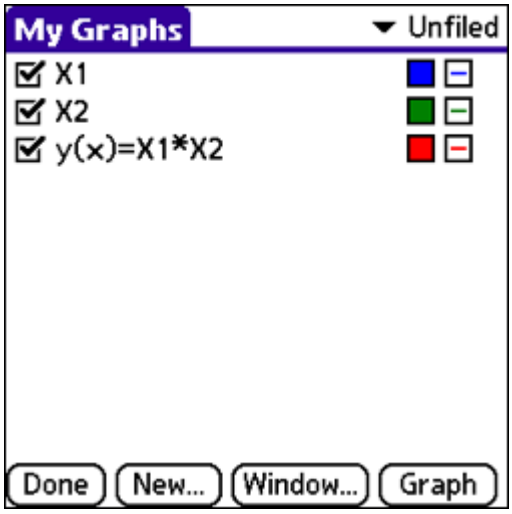
X2



X3

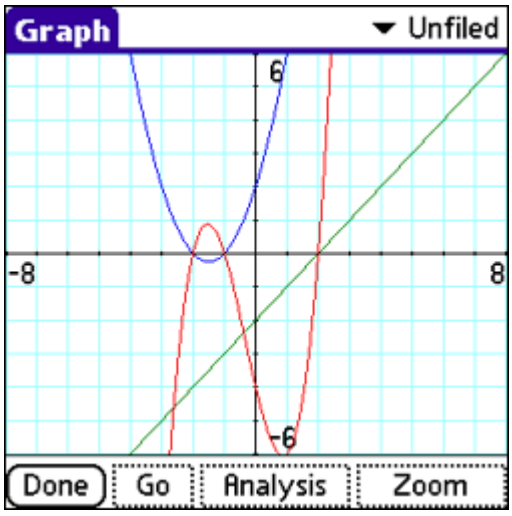


Above are three equations. X3 is a combination of X1 and X2. When graphed, X3 is the expression (x+1)(x+2)(x-2). The "X1" variable in X3 is subtituted with the expression from the graph X1. The same is true for the "X2" variable.



My Graphs shows the three graphs selected. If a name is defined as in "X1" and "X2" it is shown in place of the equation. The third graph does not have a name so the equation is shown.

When the equations above are graphed, it is clear that the red line (X3) is a combination of the X1 and X2 equations.



Equations can only use other graph names in the same category. If an equation uses a variable that is not found in the same category, it will use the variable or macro in My Data.

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5.7 Sharing Graphs

Import and Export/Beam options are available for different types of data, graphs and templates. This section discusses sharing graphs.

Export/Beam

To export or beam a data item:
- Go to My Graphs.

Option 1: export/beam individual graphs.
- Select the graph to share.
- Choose "Export/Beam" from the list. Export/Beam Options appears.
- Select the desired export/beam option.
- Follow the on-screen directions, if any are required.

Option 2: export/beam graph categories.
- Select "Export/Beam Category" from the Options menu.
- Select the desired export/beam option.
- Follow the on-screen directions, if any are required.

Four data export/beam options come with the software:

- **Export graph to file:** save the selected graph in a file that can be synchronized to the desktop for archival or sharing purposes.
- **Export category to file:** save the current category and all associated graphs in a file that can be synchronized to the desktop for archival or sharing purposes.
- **Beam graph:** beam the selected graph to another handheld that has this software.
- **Beam category:** beam the current category and all associated graphs to another handheld that has this software.

Infinity Softworks may offer additional export/beam plug-ins from its web site. Those plug-ins could include those to communicate with word processors, spreadsheets and probe systems, among others. See the Plug-ins web page at www.infinitysw.com/graph for more information.

Import

To import a data item:
- Select "Import" from the Options menu.
- Select the desired import option.
- Follow the on-screen directions, if any are required.

One data import option comes with the software:

- **Import graphs from files:** find graph files and import them. Generally, graph files are imported automatically when the software is first started. However, the expansion memory is not searched. Choose this option to import from both device and expansion memory.

Infinity Softworks may offer additional import plug-ins from its web site. These plug-ins could include ones to communicate with word processors, spreadsheets and probe systems, among others. See the Plug-ins web page at www.infinitysw.com/graph for more information.

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6 Templates

6.1 Accessing

There are three ways to get to a template:

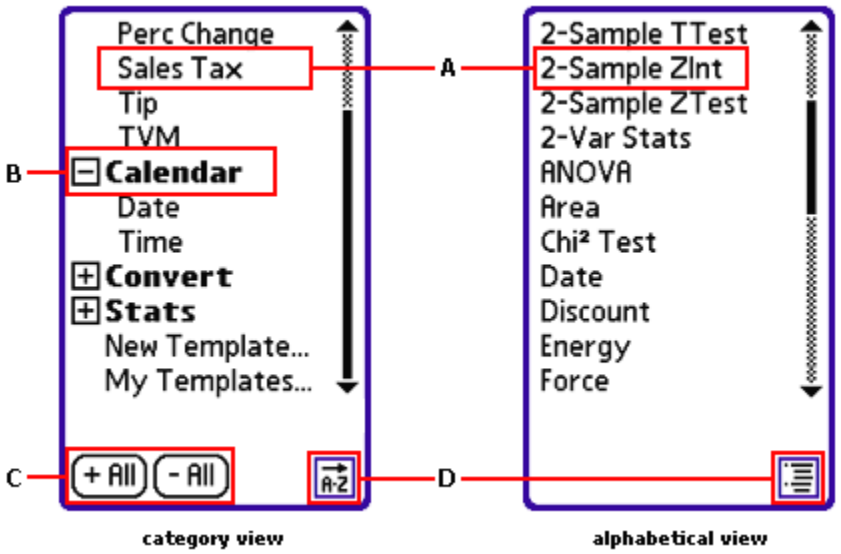
1. In the main calculator, select the Template button at the top of the screen to go see a list of templates. See the Using the Calculator : Interface Overview section for more on this button.

2. In the main calculator, select the Last Template button at the top of the screen to go to the last opened template. See the Using the Calculator : Interface Overview section for more on this button.

3. In the main calculator, select "powerOne" then select "My Templates".

6.2 Template List

The Template List displays a list of available templates and their categories. This list can be viewed in category order or in alphabetical order:



A. Template: select a template to go to that template.

B. Template Category: templates are organized into categories. If in category view and the category is closed (the plus symbol is visible next to the category), select it to open the category and see that category's templates. If in category view and the category is open (the minus symbol is visible next to the category), select it to close the category and hide that category's templates. If there are no templates in the category, that category will not be visible.

C. Open/Close All Buttons: select a button to either open all categories or close all categories.
- + All: select to open all categories.
- – All: select to close all categories.

D. Switch View Button: select to switch between category and alphabetical views.

E. Additional Options: at the bottom of the list in both category and alphabetical view are three additional options: to create a new template or go to My Templates.
- New Template: select to create a new template using the solver. See the Creating Templates section for more information.

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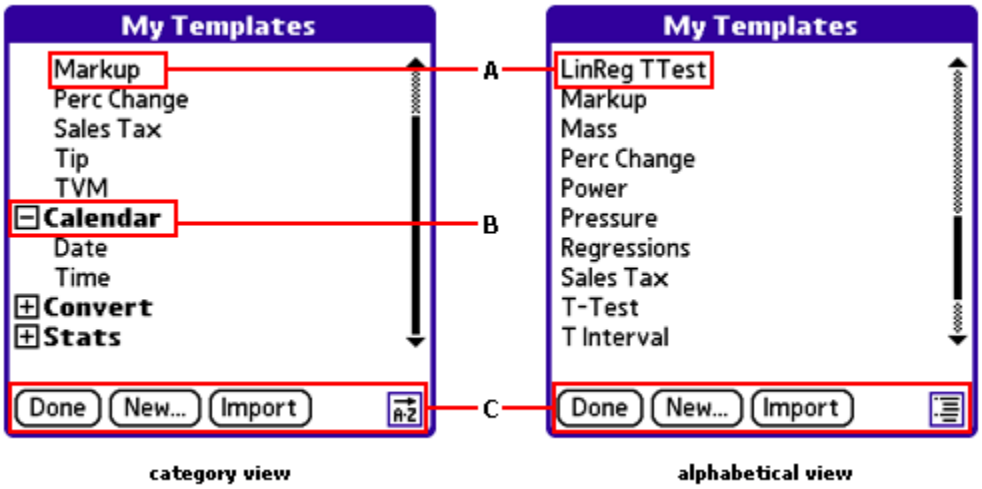
- My Templates: select to go to My Templates. See the My Templates section for more information.

6.3 My Templates

My Templates displays a list of available templates and their categories. This list can be viewed in category order or in alphabetical order:



A. Template: select the template for a list of options.

- Use: select to display the template for use.
- Edit: select to edit the template's equation. Only visible if the template can be edited.
- Export/Beam: select to export or beam templates. See the Using the Templates : Sharing Templates & Data section for more information. Only visible if the template can be exported and/or beamed.
- Delete: select to delete the template. Only visible if the template can be deleted.
- Duplicate: select to duplicate the template. Only visible if the template can be edited.
- Notes: select to view the template notes.

B. Template Category: templates are organized into categories. If in category view and the category is closed (the plus symbol is visible next to the category), select it to open the category and see that category's templates. If in category view and the category is open (the minus symbol is visible next to the category), select it to close the category and hide that category's templates. If there are no templates in the category, that category will not be visible.

C. Buttons: (from left to right)

- Done: select to leave My Templates.
- New: select to create a new template using the solver. See the Templates : Creating Templates section for more information.
- Import: select to import template. See the Using the Templates : Sharing Templates & Data section for more information.
- Switch View: select to switch between category and alphabetical views.

6.4 Using the Templates

This section discusses how templates are generally used. See the Templates : Included Templates section for details on each specific template.

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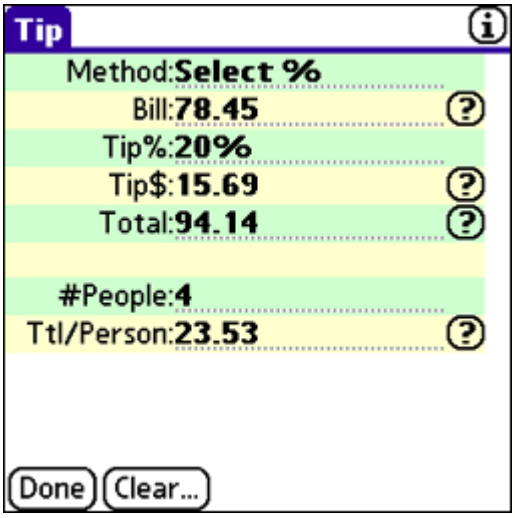
6.4.1 Quick Start Example

The Example

This is an example to quickly demonstrate how to use a template. 4 colleagues go to dinner and spend $78.45. How much is paid for the tip and total bill with a 20% tip? How much was the tip? If the bill were split evenly, what does each colleague have to pay?



Go to the Tip Template

1. Launch the software. The main calculator should be visible.

2. Select the Template button. The Template button is third from the left across the top of the main calculator. The Template List should be visible.

3. Open the Business category by selecting its name.

4. Open the Tip template by selecting its name. The Tip template should be visible.

Calculate Tip Amount and Total Bill

5. Enter $78.45 for the bill.
   - select 0.00 next to Bill.
   - enter 78.45 in the pop-up calculator using the keypad.
   - select the save ("✓") button.

6. Enter a 20% tip.
   - select 15% next to Tip.
   - choose 20% from the list.

7. Calculate the tip amount.
   - select the "?" button on the same line as Tip$.
   - the tip amount is $15.69.

8. Calculate the total bill.
   - select the "?" button on the same line as Total.
   - the total bill is $94.14.

Split the Bill

8. Enter 4 for the number of people.
   - select 1 next to #People.
   - enter 4 in the pop-up calculator using the keypad.
   - select the save ("✓") button.

9. Calculate the total per person.
   - select the "?" button on the same line as Ttl/Person.
   - the total per person is $23.53.

6.4.2 Interface Overview

All templates are similar in design. The template itself is broken into 3 columns: the first describes the variable, the second is the variable's data and the third indicates which variables can be calculated. To use any template, enter the known variables by selecting the Data column and entering each. If a table of data is required, choose or create one by selecting the label for that variable. To calculate the unknown variable, select the "?" button on its row.

For details not noted here and examples on how to use individual templates, see the desired template in the Included Templates section.

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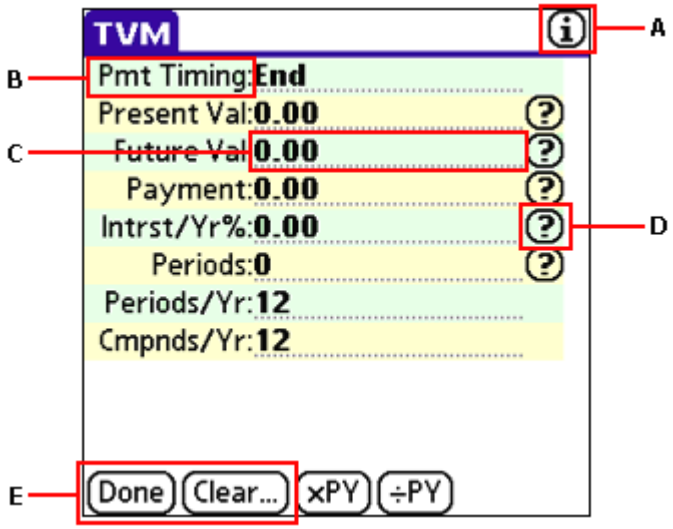
A. Template Notes: select this button to display notes about the template. Notes generally describe what the template is used for, a description of each variable and any special template instructions.

B. Variable Label: describes the variable's contents. Generally, the label is nothing more than a text description, but sometimes labels can be selected. Labels that can be selected are surrounded by a dotted border and exist for one of two reasons:



- Select a Table: some templates require a table and offer the ability to use any table, including those already created using My Data. Examples are 2-variable statistics and ANOVA templates. See the Using the Templates : Types of Variable Data section for more information on selecting and using a table. See the Using the Calculator : Memory & Storage : My Data section for more on creating tables.
- Change the Data View: some variable's can be entered or viewed in multiple ways. For example, the variable Diff H.MM in the Time template. In this case, select the variable's label to enter and calculate the same data item a different way. In the Time template, the difference in time can be entered in hour-minute (Diff H.MM) or fractional hour (Diff Hrs) format.

C. Variable Data: the value or data for the variable. To enter data, select its value and enter it. The data can be entered if it is underlined; otherwise it can only be calculated. Data can be shown in multiple ways. See the Using the Templates : Types of Variable Data section for more information.

D. Calculate "?": indicates that the variable can be calculated. Select it to perform the calculation.

E. Buttons: while there may be more than two buttons, these two exist in every template:

- Done or OK: exits the template.
- Clear or C: clears the contents of the template. This reverts the data to its defaults.

6.4.3 Types of Variable Data

There are 5 variable data types currently available. Variable data appears in the middle column of the template and can be selected and edited if it is underlined (otherwise it can only be calculated). Each variable data type is discussed here:

Numbers

Numbers are entered using the pop-up calculator. To enter a number:

- select the variable's data.
- enter the number with the keypad or use the calculator to compute it.
- select the "✓" (save button) to return to the template and save the number or choose "x" (cancel button) to return to the template without saving.

See the Using the Calculator : Interface Overview section for more information on the pop-up calculator.

Lists

Lists show a set of defined options. To choose an item from a list:

- select the variable.
- choose an option from the list, scrolling if necessary.

Tables

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Tables, or sets of data, come in two types. The first type is available for use in any template, while graphing or for calculation in the main calculator. It is considered global. The second type is available only to the selected template. This type is considered local. Global tables always have a dotted box around the variable's label.

To choose a global table for use in the template:

- select the variable's label. It will have a dotted box around it.
- Next to table, choose "None Selected" than a table name or, to create a new table, select "New". See Using the Calculator : Memory & Storage : My Data for more on creating a new table.
- Once a table is selected, Column appears. Choose a column number or range of numbers if applicable.
- Select "OK" to save the table selection or "Cancel" to throw out any new selection.

If more than one table is required, often a template will guess at the additional tables. To change that guess, follow the same process for the additional templates.

To edit local or global table data:

- select the variable.
- enter data into the table by selecting each cell and entering data with the same pop-up calculator used with Numbers described above.
- select "OK" to save the data or "Cancel" to throw out those changes. If the table is global, any changes are saved with the global table as well as with the template's copy.

Dates

Dates are entered using a selector similar to other applications. On Palm OS handhelds, however, the year can be changed directly and in the range 1900 to 3000. To choose a date:

- select the variable.
- choose a year.
- choose a month.
- choose a day.

Times

Times are entered using a selector similar to other applications. To choose a time:

- select the variable.
- choose the hour by highlighting it and using the up/down scroll arrows.
- choose minutes by selecting each box in turn and using the up/down scroll arrows.
- choose am or pm (if not 24 hour time).
- select "OK" to save the data or "Cancel" to throw out those changes.

6.4.4 Template Preferences

These preferences impact the entire template.

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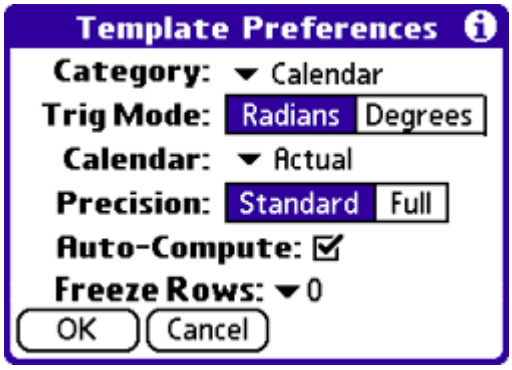
Category
In My Templates and Template List, templates can be sorted into categories. Templates can be moved to any category. Choose a category from the list or select "New Category" to create a new one. Categories only exist as long as there are templates in them. To delete a category, move all the templates in that category to another category or delete all templates in that category.



Trig Mode
Calculates trigonometric functions as either radians or degrees.

Calendar
Date arithmetic can be performed using an actual year, 30 day month/360 day year, actual/360 or actual/365 calendar. Some templates allow for this change directly in the template itself.

- Actual: counts the actual number of days in a month and the total number of days in a year, including leap years.
- 30/360: treats all months as though they have 30 days and years as though they have 360 days.
- Actual/360: counts the actual number of days in a month, but treats years as though they have 360 days.
- Actual/365: counts the actual number of days in a month, but treats years as though they have 365 days.

These different day count methods are sometimes referred to as "basis" or "day count basis" and are frequently used in financial calculations.

Precision
Some calculations require an iterative search for the answer (e.g., TVM interest rates) and take more than 1 second to calculate. When this occurs, a Computing dialog will appear. Precision affects the time of the calculation. Setting it to "Full" will calculate until full precision is reached. Setting it to "Standard" will only calculate to the displayed decimal places. Full precision takes longer to calculate but is more accurate than standard precision.

Auto-Compute
When auto-compute is checked, the application will automatically determine when the "?" should be visible. When a value is entered into the template, a "?" will appear next to any other variable that may be affected by the change. When a value is recomputed, the question marks will disappear. While auto-compute is checked, any other values that can automatically be recalculated will be after each change.

For example, if a template contains just two variables (such as most conversion templates), changing the value of one variable will automatically cause the other variable to be recalculated. If unchecked, the compute "?" will remain visible at all times, and values will only be recalculated when the "?" button is selected.

Freeze Rows
When a template is long, often it is handy to freeze a certain number of rows at the top. These rows will always remain visible. 0 means no rows remain frozen, 1 means the first row at the top of the template will always remain visible, and so on.

6.4.5 Variable Preferences

These preferences impact each variable independently. To set the preferences for a variable, first choose it from the Variable pop-up list. Selecting "Set All" will set all the variables to the current variable's preferences.

Variable
The variable to set. The preferences change with different selected variables.

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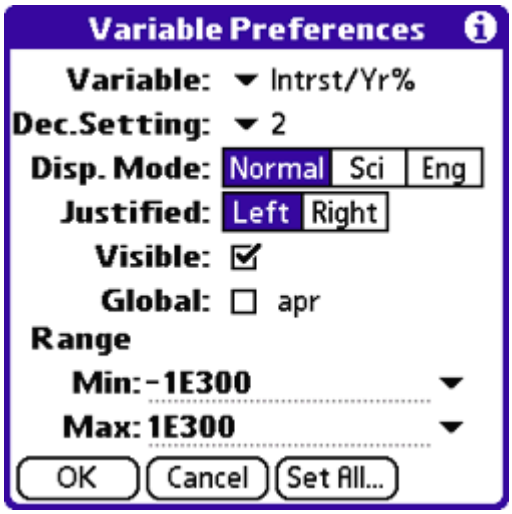
Dec Setting
The number of decimal places to display.

Float shows all available decimal places. 0 through 11 shows that many decimal places. With very large numbers, fewer decimal places may be displayed because of the total number of places available to show in the view window.

This is hidden for lists, tables, dates and times.



Disp Mode
Display numbers in normal, scientific or engineering notation.

Normal mode displays numbers as would normally be written on paper or, if the number is too large or too small to display all places, in scientific notation. Scientific mode displays numbers in 3.45e67 format. The number of places displayed after the decimal point is determined by the decimal setting. Engineering mode uses the decimal setting to determine a number of displayed significant digits and then adjusts the exponent to be a multiple of 3. The number of significant digits is 1 plus the decimal setting.

This is hidden for lists, tables, dates and times.

Justified
Show the variable's data left or right justified within the template.

Visible
If checked, the variable and its data will be visible in the template; otherwise, it will be hidden from view. A variable that is hidden will not be recalculated even if "Auto-Compute" is checked. It will also not be cleared if the "Clear" button is selected.

Global
If checked, global allows the variable's data to be shared with other templates. The equation variable, which may be different than the variable's label, is listed next to the "Global" checkbox. For this variable to be shared with another template, the other template must contain the equation variable exactly as shown in the first template.

Range
Range is available if the variable requires an iterative search to calculate its value. The range is the maximum and minimum starting points for calculation. The closer these are, the faster and more accurately a value can be derived.

This is hidden when the variable does not need to be solved with an iterative process. See Creating Templates : How the Solver Works for more information.

6.4.6 Sharing Templates & Data

Import and Export/Beam options are available for different types of data, graphs and templates. This section discusses sharing templates and template data.

Export/Beam
Option 1: export/beam templates.

- Select the template to share.
- Choose "Export/Beam" from the list if the template can be shared. If it cannot be shared, this option does not appear. Export/Beam Options appears.
- Select the desired export/beam option.
- Follow the on-screen directions, if any are required.

Option 2: export/beam template data.

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- Open the template (select the template and choose "Use" from the list).
- Select "Export/Beam" from the Options menu.
- Select the desired export/beam option.
- Follow the on-screen directions, if any are required.

Five data export/beam options come with the software:

- **Export template to file:** save the selected graph in a file that can be synchronized to the desktop for archival or sharing purposes.
- **Export category to file:** save the current category and all associated templates in a file that can be synchronized to the desktop for archival or sharing purposes.
- **Beam template:** beam the selected template to another handheld that has this software.
- **Beam category:** beam the current category and all associated templates to another handheld that has this software.
- **Write results to Memo Pad**: saves the resulting calculations to the Memo Pad.

Infinity Softworks may offer additional export/beam plug-ins from its web site. These plug-ins could include ones to communicate with word processors, spreadsheets and probe systems, among others. See the Plug-ins web page at www.infinitysw.com/graph for more information.

Import

Option 1: import templates.

- Select "Import" at the bottom of My Templates.
- Select the desired import option.
- Follow the on-screen directions, if any are required.

Option 2: import template data.

- Open the template (select the template and choose "Use" from the list).
- Select "Import" from the Options menu.
- Select the desired import option.
- Follow the on-screen directions, if any are required.

Two data import option comes with the software:

- **Import templates from files:** find template files and import them. Generally, template files are imported automatically when the software is first started. However, the expansion memory is not searched. Choose this option to import from both device and expansion memory.
- **Import data items from files:** find data item files and import them. Generally, data items are imported automatically when the software is first started. However, the expansion memory is not searched. Choose this option to import from both device and expansion memory.

Infinity Softworks may offer additional import plug-ins from its web site. These plug-ins could include ones to communicate with word processors, spreadsheets and probe systems, among others. See the Plug-ins web page at www.infinitysw.com/graph for more information.

6.5 Included Templates

These templates are included with the software. Additional templates are available to download and install from Infinity Softworks' web site: www.infinitysw.com/graph.

Included template are sorted into the following categories:

Business

- Discount
- Markup
- Perc Change
- Sales Tax

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- Tip
- TVM

Calendar
- Date
- Time

Convert
- Area
- Energy
- Force
- Length
- Mass
- Power
- Pressure
- Temperature
- Velocity
- Volume

Stats
- 1-Prop ZInt
- 1-Prop ZTest
- 1-Var Stats
- 2-Prop ZInt
- 2-Prop ZTest
- 2-Sample FTest
- 2-Sample TInt
- 2-Sample TTest
- 2-Sample ZInt
- 2-Sample ZTest
- 2-Var Stats
- ANOVA
- Chi2 Test
- LinReg TTest
- Regressions
- T-Test
- T Interval
- Z-Test
- Z Interval

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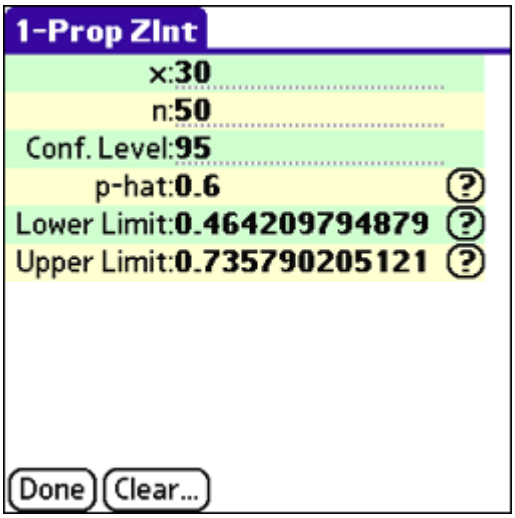
6.5.1 One (1)

This section covers included templates beginning with the number 1.

6.5.1.1 1-Proportion Z Confidence Interval

This template is for 1-proportion *z* confidence intervals. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description
This template calculates a confidence interval for an unknown population proportion of successes p.



Variables

- **x:** count of successes in the sample.
- **n:** count of observations in the sample.
- **Conf. Level:** confidence coefficient entered as a percentage (0-100) or as a decimal (0-1).
- **p-hat:** sample proportion of successes.
- **Lower Limit:** lower *z* confidence limit for p.
- **Upper Limit:** upper *z* confidence limit for p.

Example

Given the following data:

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
x	30	
n	50	
Conf. Level	95	

Select "?" in the p-hat row to calculate (may calculate automatically). The following answers are returned:

Variable	Calculated
p-hat	0.6
Lower Limit	0.4642
Upper Limit	0.7358

6.5.1.2 1-Variable Statistics

This template is for 1-variable descriptive statistics. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates

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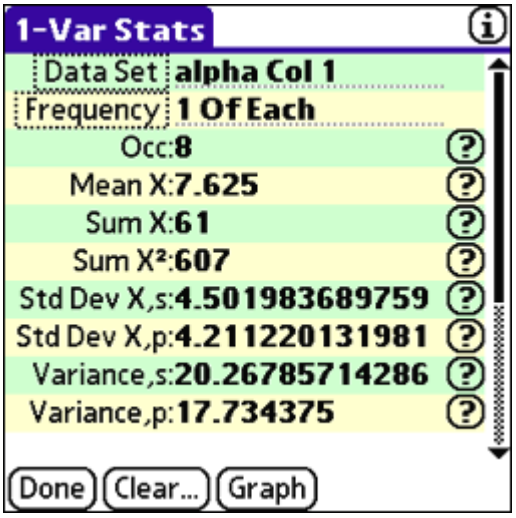
section.

Description
This template calculates descriptive statistics for one-variable data sets.



Variables

- **Data Set:** data set to analyze. Select the label to choose a table column or create a new one.
- **Frequency:** frequency list for the data set. Select the label to choose a table column or create a new one specifying the frequencies with which each observation occurs. The default frequencies are 1 of Each.
- **Occ:** total number of observations in the data set.
- **Mean X:** mean of x values. (Also known as weighted average.)
- **Sum X:** sum of x values.
- **Sum X^2:** sum of squared x values.
- **Std Dev X,s:** sample standard deviation (commonly denoted s).
- **Std Dev X,p:** population standard deviation (commonly denoted σ).
- **Variance,s:** sample variance (commonly denoted s^2).
- **Variance,p:** population variance (commonly denoted σ^2).
- **Min X:** minimum x value.
- **1st Qrtl:** median point between minimum and the median values, the 25th percentile. The calculation for finding the first quartile uses Tukey's method, which includes the median. This may differ from other calculators.
- **Median:** a middle value in the ordered data, the 50th percentile.
- **3rd Qrtl:** median point between the median and maximum values, the 75th percentile. The calculation for finding the third quartile uses Tukey's method, which includes the median. This may differ from other calculators.
- **Max X:** maximum x value.
- **Range X:** difference between minimum and maximum values.

This template automatically calculates a weighted average when frequencies are different for each data point.

Graphing
To graph the statistics, select the "Graph" button. The graph is a scatter plot of the observations (on the vertical axis) versus the number of the observation in the data list (on the horizontal axis).

Example

Given the following data:

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Data Set	{5; 2; 8; 6; 3; 10; 12; 15}	
Frequency	1 Of Each	

Select "?" in the Occ row to calculate (may calculate automatically). The following answers are returned:

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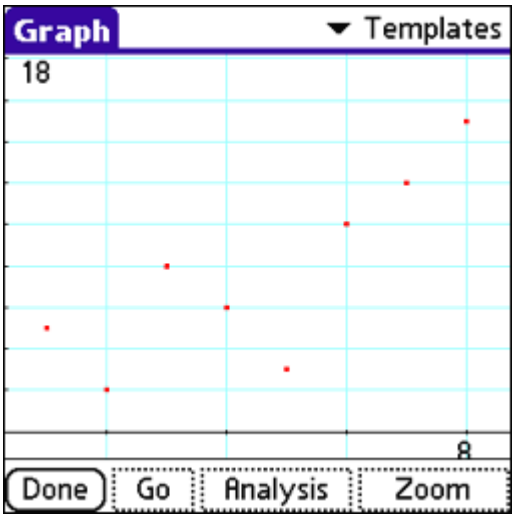
Variable	Calculated
Occ	8
Mean X	7.625
Sum X	61
Sum X^2	607
Std Dev X,s	4.5020
Std Dev X,p	4.2112
Variance,s	20.2679
Variance,p	17.7344
Min X	2
1st Qrtl	4
Median	7
3rd Qrtl	11
Max X	15
Range X	13

The graph would appear as follows:



6.5.1.3 1-Proportion Z Test

This template is for tests about a single population proportion. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

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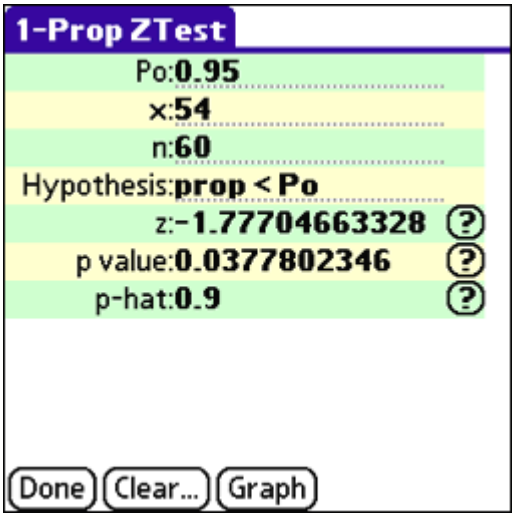
Description
This template tests a hypothesis about a population proportion of successes prop. The null hypothesis is H_0 : prop = Po.



Variables

- **Po:** the hypothesized value of prop (0 <= Po <= 1).
- **x:** count of successes in the sample.
- **n:** count of observations in the sample.
- **Hypothesis:** the three possible alternative hypotheses are prop not equal Po, prop > Po, or prop < Po.
- **z:** *z*-test statistic.
- **p value:** probability value or observed significance level of the test.
- **p-hat:** sample proportion of successes.

Graphing
To graph the test, select the "Graph" button. The graph displays the p-value as a shaded area of the standard normal distribution.

Example

Given the following data:

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Po	0.95	
x	54	
n	60	
Hypothesis	prop < Po	Choose from the list

Select "?" in the p-hat row to calculate (may calculate automatically). The following answers are returned:

Variable	Calculated
z	-1.7770
p value	0.03778
p-hat	0.9
Hypothesis	prop < Po

The graph would appear as follows:

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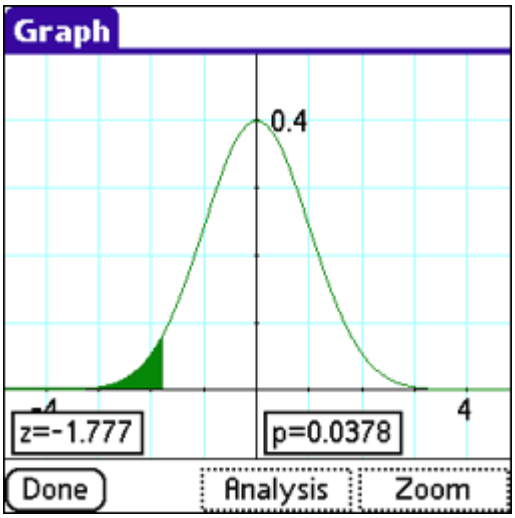


6.5.2 Two (2)

This section covers included templates beginning with the number 2.

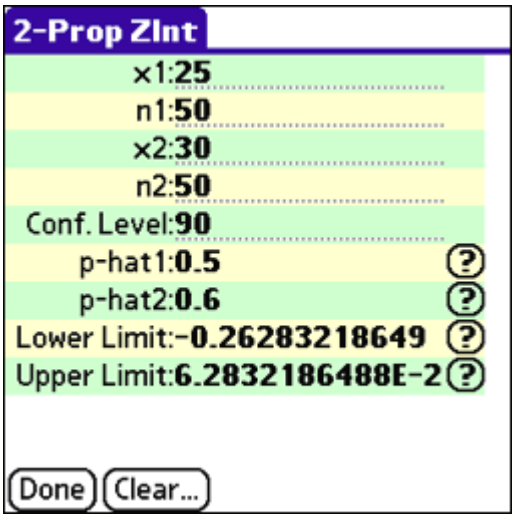
6.5.2.1 2-Proportion Z Confidence Interval

This template is for 2-proportion *z* confidence intervals. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description
This template calculates a confidence interval for the difference between two population proportions of successes, p1 and p2, based on two independent random samples.

Variables

- **x1:** count of successes in the first sample. Must be a positive integer less than n1.
- **n1:** count of observations in the first sample. Must be a positive integer number.
- **x2:** count of successes in the second sample. Must be a positive integer less than n2.
- **n2:** count of observations in the second sample. Must be a positive integer number.
- **Conf Level:** confidence coefficient entered as a percentage (0-100) or as a decimal (0-1).
- **p-hat1:** proportion of successes in the first sample.
- **p-hat2:** proportion of successes in the second sample.
- **Lower Limit:** lower *z* confidence limit for the difference p1 – p2.
- **Upper Limit:** upper *z* confidence limit for the difference p1 – p2.



Example

Given the following data:

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Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
x1	25	
n1	50	
x2	30	
n2	50	
Conf. Level	90	

Select "?" in the p-hat1 row to calculate (may calculate automatically). The following answers are returned:

Variable	Calculated
p-hat1	0.5
p-hat2	0.6
Lower Limit	-0.2628
Upper Limit	6.2832e-2

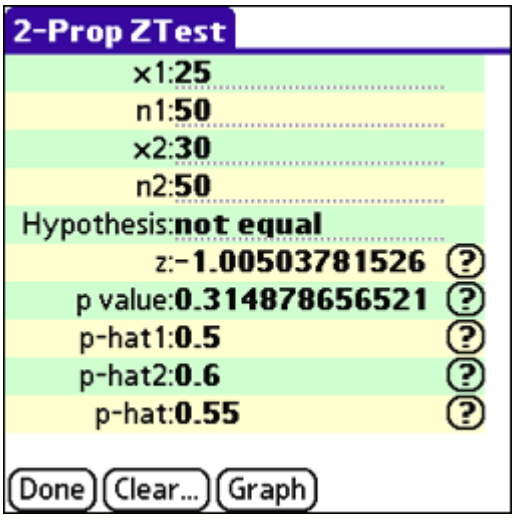
6.5.2.2 2-Proportion Z Test

This template is for 2-proportion *z* tests about the equality of population proportions. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description
This template tests the equality of two population proportions, p1 and p2, based on independent random samples. The null hypothesis is Ho : p1 – p2 = 0 or equivalently Ho : p1 = p2.

Variables

- **x1:** count of successes in the first sample. Must be a positive integer less than n1.
- **n1:** count of observations in the first sample. Must be a positive integer number.
- **x2:** count of successes in the second sample. Must be a positive integer less than n2.
- **n2:** count of observations in the second sample. Must be a positive integer number.
- **Hypothesis:** the three possible alternative hypotheses are p1 not equal p2, p1 > p2, or p1 < p2.
- **z:** *z*-test statistic.
- **p value:** probability value or observed significance level of the test.
- **p-hat1:** (sample) proportion of successes in the first sample.
- **p-hat2:** (sample) proportion of successes in the second sample.
- **p-hat:** proportion of successes in the combined samples.



Graphing
To graph the test, select the "Graph" button. The graph displays the p-value as a shaded area of the standard normal distribution.

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Example

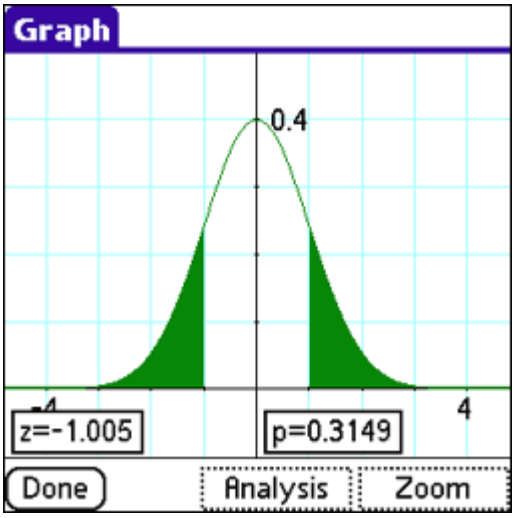
Given the following data:

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
x1	25	
n1	50	
x2	30	
n2	50	
Hypothesis	not equal	Choose from the list

Select "?" in the z row to calculate (may calculate automatically). The following answers are returned:

Variable	Calculated
z	-1.0050
p value	0.3149
p-hat1	0.5
p-hat2	0.6
p-hat	0.55

The graph would appear as follows:



6.5.2.3 2-Sample F-Test

This template is for 2-sample F tests about the equality of population variances. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description

This template tests the equality of two population variances based on independent random samples from two normal

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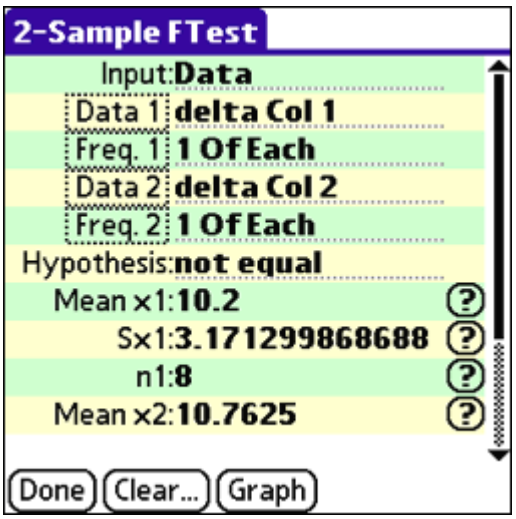
populations. The null hypothesis is that the two populations have the same variance (and standard deviation), that is $s_1^2 = s_2^2$. The available variables depend on whether data or stats are used to perform the calculation (designated by variable "Input"). The stats option is used to directly enter values of the sample statistics; the data option is selected if the sample statistics are to be computed from the data.

Variables



- **Input:** whether data or statistics are used to compute the appropriate values.
- **Data 1:** first data set to analyze. Select the label to choose a table column or create a new one.
- **Freq. 1:** frequency list for the first data set. Select the label to choose a table column or create a new one. It defaults to 1 of Each.
- **Data 2:** second data set to analyze. Select the label to choose a table column or create a new one.
- **Freq. 2:** frequency list for the second data set. Select the label to choose a table column or create a new one. It defaults to 1 of Each.
- **Hypothesis:** the three possible alternative hypotheses are that the variance of the first population is not equal to, is less than or is greater than the variance of the second population.
- **Mean x1:** first sample mean.
- **Sx1:** first sample standard deviation.
- **n1:** number of observations in the first data set. Must be an integer greater than 1.
- **Mean x2:** second sample mean.
- **Sx2:** second sample standard deviation.
- **n2:** number of observations in the second data set. Must be an integer greater than 1.
- **F:** F-test statistic.
- **p value:** probability value or observed significance level of the test.

Graphing

To graph the test, select the "Graph" button. The graph displays the p-value as a shaded area of an F distribution.

Example

Given the following data:

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Input	Data	
Data 1	{5.0; 6.8; 10.2; 13.2; 11.4; 14.6; 9.2; 11.2}	
Freq. 1	1 Of Each	
Data 2	{6.8; 9.2; 8.8; 13.2; 11.2; 14.9; 10.2; 11.8}	
Freq. 2	1 Of Each	
Hypothesis	not equal	Choose from the list

Select "?" in the Mean x1 row to calculate (may calculate automatically). The following answers are returned:

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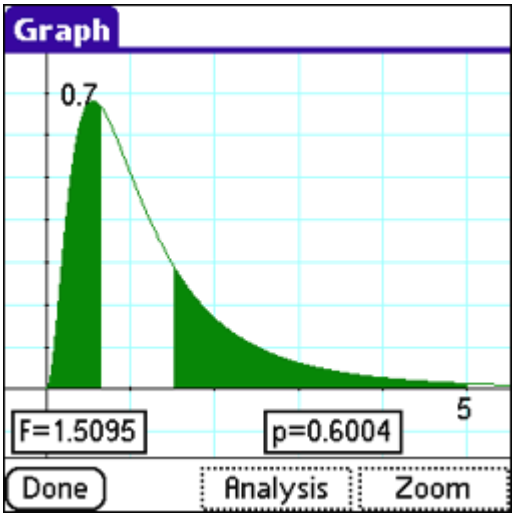
Variable	Calculated
Mean x1	10.2
Sx1	3.1713
n1	8
Mean x2	10.7625
Sx2	2.5812
n2	8
F	1.5095
p value	0.6004

The graph would appear as follows:



6.5.2.4 2-Sample T Confidence Interval

This template is for 2-sample *t* confidence intervals. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description
This template calculates a confidence interval for the difference between two population means, mean1 and mean2. It assumes two independent random samples from normal populations with unknown standard deviations. The available variables depend on whether data or stats are used to perform the calculation (designated by variable "Input"). The stats option is used to directly enter values of the sample statistics; the data option is selected if the sample statistics are to be computed from the data.

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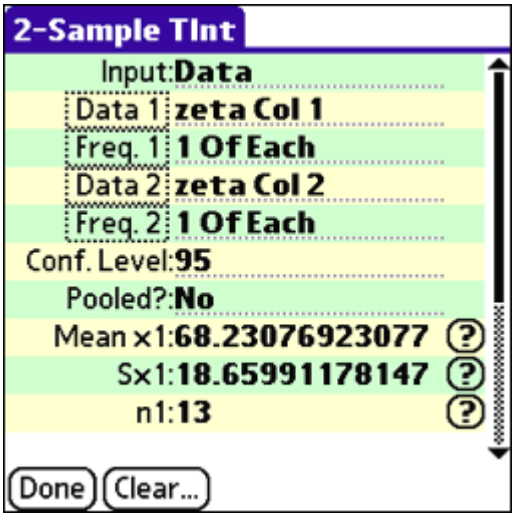
Variables



- **Input:** whether data or statistics are used to compute the appropriate values.
- **Data 1:** first data set to analyze. Select the label to choose a table column or create a new one.
- **Freq. 1:** frequency list for the first data set. Select the label to choose a table column or create a new one. It defaults to 1 of Each.
- **Data 2:** second data set to analyze. Select the label to choose a table column or create a new one.
- **Freq. 2:** frequency list for the second data set. Select the label to choose a table column or create a new one. It defaults to 1 of Each.
- **Conf Level:** confidence coefficient entered as a percentage (0-100) or as a decimal (0-1).
- **Pooled?:** whether to pool the variances or not (yes, no).
- **Mean x1:** first sample mean.
- **Sx1:** first sample standard deviation.
- **n1:** number of observations in the first data set. Must be an integer greater than 1.
- **Mean x2:** second sample mean.
- **Sx2:** second sample standard deviation.
- **n2:** number of observations in the second data set. Must be an integer greater than 1.
- **Sx pooled:** the pooled standard deviation. Appears if variances are pooled.
- **Lower Limit:** lower *t* confidence limit for mean1 - mean2.
- **Upper Limit:** upper *t* confidence limit for mean1 - mean2.
- **df:** degrees of freedom.

Example

Given the following data:

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Input	Data	
Data 1	{59; 73; 74; 61; 92; 60; 84; 54; 73; 47; 102; 75; 33}	
Freq. 1	1 Of Each	
Data 2	{71; 63; 40; 34; 38; 48; 60; 75; 47; 41; 44; 86; 53}	
Freq. 2	1 Of Each	
Conf. Level	95	
Pooled	Yes	Choose from the list

Select "?" in the Mean x1 row to calculate (may calculate automatically). The following answers are returned:

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Variable	Calculated
Mean x1	68.2308
Sx1	18.6599
n1	13
Mean x2	53.8462
Sx2	16.0148
n2	13
Sx pooled	17.3877
Lower Limit	0.3088
Upper Limit	28.4605
df	24

If pooled is set to No, the following answers are returned:

Variable	Calculated
Mean x1	68.2308
Sx1	18.6599
n1	13
Mean x2	53.8462
Sx2	16.0148
n2	13
Lower Limit	0.2916
Upper Limit	28.4776
df	23.4602

6.5.2.5 2-Sample T Test

This template is for 2-sample *t* tests about the equality of population means. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description
This template tests the equality of two population means, mean1 and mean2, based on independent random samples from two normal populations. The null hypothesis is Ho : mean1 - mean2 = 0 or equivalently Ho : mean1 = mean2. The available variables depend on whether data or stats are used to perform the calculation (designated by variable "Input"). The stats option is used to directly enter values of the sample statistics; the data option is selected if the sample statistics are to be computed from the data.

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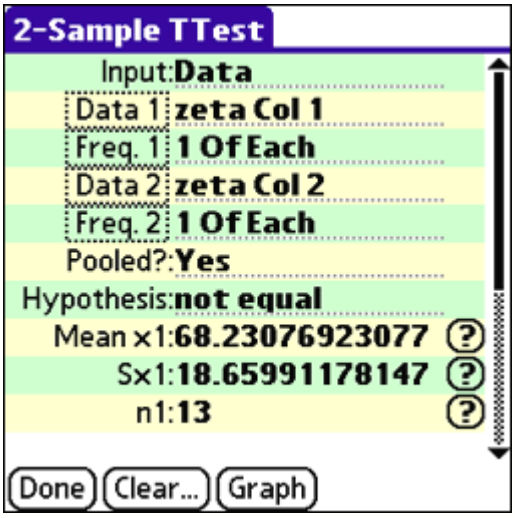
Variables



- **Input:** whether data or statistics are used to compute the appropriate values.
- **Data 1:** first data set to analyze. Select the label to choose a table column or create a new one.
- **Freq. 1:** frequency list for the first data set. Select the label to choose a table column or create a new one. It defaults to 1 of Each.
- **Data 2:** second data set to analyze. Select the label to choose a table column or create a new one.
- **Freq. 2:** frequency list for the second data set. Select the label to choose a table column or create a new one. It defaults to 1 of Each.
- **Pooled?:** whether to pool the variances or not (yes, no).
- **Hypothesis:** the three possible alternative hypotheses are mean1 not equal mean2, mean1 > mean2, or mean1 < mean2.
- **Mean x1:** first sample mean.
- **Sx1:** first sample standard deviation.
- **n1:** number of observations in the first data set. Must be an integer greater than 1.
- **Mean x2:** second sample mean.
- **Sx2:** second sample standard deviation.
- **n2:** number of observations in the second data set. Must be an integer greater than 1.
- **Sx pooled:** the pooled standard deviation. Appears if variances are pooled
- **df:** degrees of freedom.
- **t:** *t*-test statistic.
- **p value:** probability value or observed significance level of the test.

Graphing

To graph the test, select the "Graph" button. The graph displays the p-value as a shaded area of a t distribution.

Example

Given the following data:

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Input	Data	
Data 1	{59; 73; 74; 61; 92; 60; 84; 54; 73; 47; 102; 75; 33}	
Freq. 1	1 Of Each	
Data 2	{71; 63; 40; 34; 38; 48; 60; 75; 47; 41; 44; 86; 53}	
Freq. 2	1 Of Each	
Pooled	Yes	
Hypothesis	not equal	Choose from the list

Select "?" in the Mean x1 row to calculate (may calculate automatically). The following answers are returned:

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Variable	Calculated
Mean x1	68.2308
Sx1	18.6599
n1	13
Mean x2	53.8462
Sx2	16.0148
n2	13
Sx pooled	17.3877
df	24
t	2.1092
p value	4.555e-2

If pooled is set to No, the following answers are returned:

Variable	Calculated
Mean x1	68.2308
Sx1	18.6599
n1	13
Mean x2	53.8462
Sx2	16.0148
n2	13
df	23.4602
t	2.1092
p value	0.0458

The graph would appear as follows:

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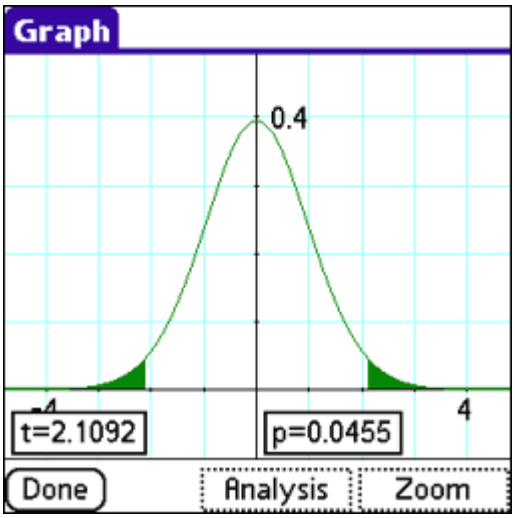
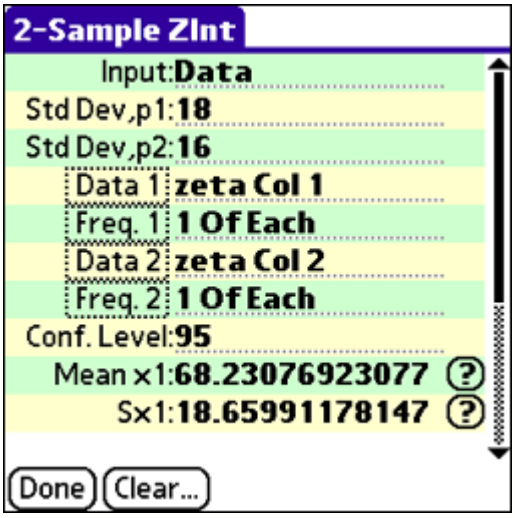


6.5.2.6 2-Sample Z Confidence Interval

This template is for 2-sample *z* confidence intervals. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description
This template calculates a confidence interval for the difference between two population means, mean1 - mean2, based on independent random samples from two populations whose standard deviations are known. The available variables depend on whether data or stats are used to perform the calculation (designated by variable "Input"). The stats option is used to directly enter values of the sample statistics; the data option is selected if the sample statistics are to be computed from the data.

Variables



- **Input:** whether data or statistics are used to compute the appropriate values.
- **Std Dev,p1:** population standard deviation for the first data set. Must be a positive integer or floating point number.
- **Std Dev,p2:** population standard deviation for the second data set. Must be a positive integer or floating point number.
- **Data 1:** first data set to analyze. Select the label to choose a table column or create a new one.
- **Freq. 1:** frequency list for the first data set. Select the label to choose a table column or create a new one. It defaults to 1 of Each.
- **Data 2:** second data set to analyze. Select the label to choose a table column or create a new one.
- **Freq. 2:** frequency list for the second data set. Select the label to choose a table column or create a new one. It defaults to 1 of Each.
- **Conf Level:** confidence coefficient entered as a percentage (0-100) or as a decimal (0-1).
- **Mean x1:** first sample mean.
- **Sx1:** first sample standard deviation.
- **n1:** number of observations in the first data set. Must be an integer greater than 1.
- **Mean x2:** second sample mean.
- **Sx2:** second sample standard deviation.
- **n2:** number of observations in the second data set. Must be an integer greater than 1.
- **Lower Limit:** lower *z* confidence limit for mean1 - mean2.

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- **Upper Limit:** upper *z* confidence limit for mean1 - mean2.

Example

Given the following data:

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Input	Data	
Std Dev,p1	18	
Std Dev,p2	16	
Data 1	{59; 73; 74; 61; 92; 60; 84; 54; 73; 47; 102; 75; 33}	
Freq. 1	1 Of Each	
Data 2	{71; 63; 40; 34; 38; 48; 60; 75; 47; 41; 44; 86; 53}	
Freq. 2	1 Of Each	
Conf. Level	95	

Select "?" in the Mean x1 row to calculate (may calculate automatically). The following answers are returned:

Variable	Calculated
Mean x1	68.2308
Sx1	18.6599
n1	13
Mean x2	53.8462
Sx2	16.0148
n2	13
Lower Limit	1.2931
Upper Limit	27.4761

6.5.2.7 2-Sample Z Test

This template is for 2-sample *z* test tests of the equality of population means. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description
This template tests the equality of two population means, mean1 and mean2, based on independent random samples from two populations whose standard deviations are known. The null hypothesis is Ho : mean1 - mean2 = 0 or equivalently Ho : mean1 = mean2. The available variables depend on whether data or stats are used to perform the calculation (designated by variable "Input"). The stats option is used to directly enter values of the sample statistics; the data option is selected if the sample statistics are to be computed from the data.

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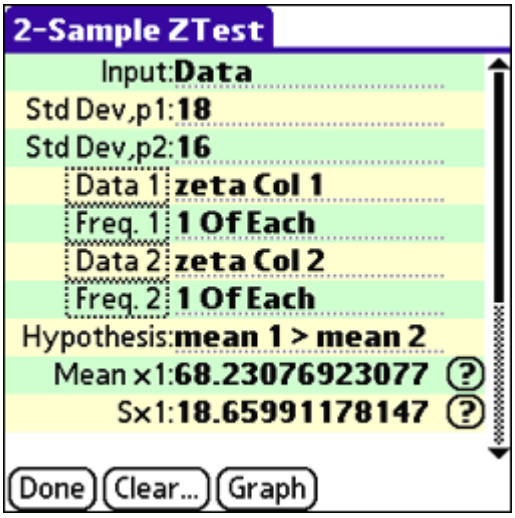
Variables



- **Input:** whether data or statistics are used to compute the appropriate values.
- **Std Dev,p1:** population standard deviation for the first data set. Must be a positive integer or floating point number.
- **Std Dev,p2:** population standard deviation for the second data set. Must be a positive integer or floating point number.
- **Data 1:** first data set to analyze. Select the label to choose a table column or create a new one.
- **Freq.1:** frequency list for the first data set. Select the label to choose a table column or create a new one. It defaults to 1 of Each.
- **Data 2:** second data set to analyze. Select the label to choose a table column or create a new one.
- **Freq.2:** frequency list for the second data set. Select the label to choose a table column or create a new one. It defaults to 1 of Each.
- **Hypothesis:** the three possible alternative hypotheses are mean1 not equal mean2, mean1 > mean2, or mean1 < mean2.
- **Mean x1:** first sample mean.
- **Sx1:** first sample standard deviation.
- **n1:** number of observations in the first data set. Must be an integer greater than 1.
- **Mean x2:** second sample mean.
- **Sx2:** second sample standard deviation.
- **n2:** number of observations in the second data set. Must be an integer greater than 1.
- **z:** *z*-test statistic.
- **p value:** probability value or observed significance level of the test.

Graphing

To graph the test, select the "Graph" button. The graph displays the p-value as a shaded area of the standard normal distribution.

Example

Given the following data:

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Input	Data	
Std Dev,p1	18	
Std Dev,p2	16	
Data 1	{59; 73; 74; 61; 92; 60; 84; 54; 73; 47; 102; 75; 33}	
Freq. 1	1 Of Each	
Data 2	{71; 63; 40; 34; 38; 48; 60; 75; 47; 41; 44; 86; 53}	
Freq. 2	1 Of Each	
Hypothesis	mean1 > mean2	Choose from the list

Select "?" in the Mean x1 row to calculate (may calculate automatically). The following answers are returned:

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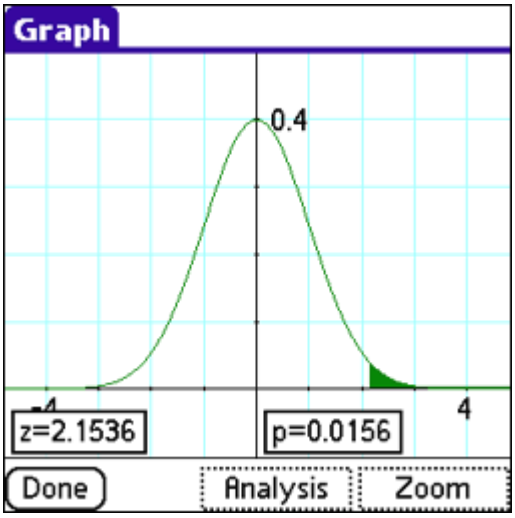
Variable	Calculated
Mean x1	68.2308
Sx1	18.6599
n1	13
Mean x2	53.8462
Sx2	16.0148
n2	13
z	2.1536
p value	0.0156

The graph would appear as follows:



6.5.2.8 2-Variable Statistics

This template is for 2-variable descriptive statistics. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description
This template calculates descriptive statistics for two-variable data sets (variables x and y) with equal numbers of observations.

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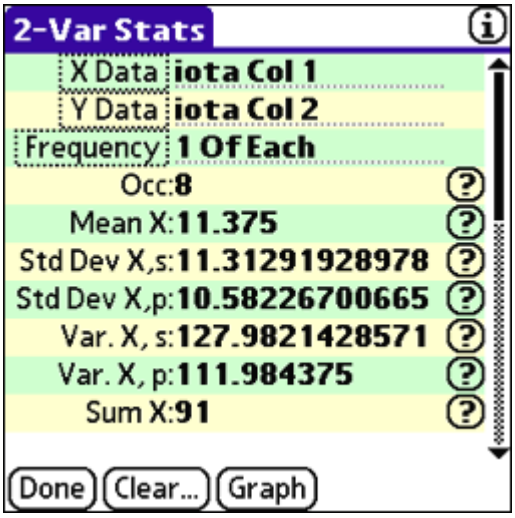

Variables

- **X Data:** x data set to analyze. Select the label to choose a table column or create a new one. Must have the same number of data points as Y Data.
- **Y Data:** y data set to analyze. Select the label to choose a table column or create a new one. Must have the same number of data points as X Data.
- **Frequency:** frequency list for the data set. Select the label to choose a table column or create a new one specifying the frequencies with which each observation occurs. The default frequencies are 1 of Each.
- **Occ:** common number of observations in the two data sets (x data with frequency and y data with frequency must have the same occurrences).
- **Mean X:** mean of x values.
- **Std Dev X,s:** sample standard deviation of x values (commonly denoted s).
- **Std Dev X,p:** population standard deviation of x values (commonly denoted σ).
- **Var. X,s:** sample variance of x values (commonly denoted s^2).
- **Var. X,p:** population variance of x values (commonly denoted σ^2).
- **Sum X:** sum of x values.
- **Sum X^2:** sum of squared x values.
- **Min X:** minimum x value.
- **Max X:** maximum x value.
- **Range X:** difference between x minimum and maximum values.
- **Mean Y:** mean of y values.
- **Std Dev Y,s:** sample standard deviation of y values (commonly denoted s).
- **Std Dev Y,p:** population standard deviation of y values (commonly denoted σ).
- **Var. Y,s:** sample variance of y values (commonly denoted s^2).
- **Var. Y,p:** population variance of y values (commonly denoted σ^2).
- **Sum Y:** sum of y values.
- **Sum Y^2:** sum of squared y values.
- **Min Y:** minimum y value.
- **Max Y:** maximum y value.
- **Range Y:** difference between minimum and maximum y values.
- **Sum XY:** sum of x times y values.

Graphing

To graph the statistics, select the "Graph" button. The graph is a scatter plot of (x,y) pairs.

Example

Given the following data:

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Data X	{-1; 0; 7; 12; 4; 14; 25; 30}	
Data Y	{10; 32; 128; 213; 75; 250; 446; 540}	
Frequency	1 Of Each	

Select "?" in the Occ row to calculate (may calculate automatically). The following answers are returned:

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Variable	Calculated
Occ	8
Mean X	11.375
Std Dev X,s	11.3129
Std Dev X,p	10.5823
Var. X,s	127.9821
Var X,p	111.9844
Sum X	91
Sum X^2	1,931
Min X	-1
Max X	30
Range X	31
Mean Y	211.75
Std Dev Y,s	193.7648
Std Dev Y,p	181.2503
Var. Y,s	37,544.7857
Var. Y,p	32,851.6875
Sum Y	1,694
Sum Y^2	621,518
Min Y	10
Max Y	540
Range Y	530
Sum XY	34,592

The graph would appear as follows:

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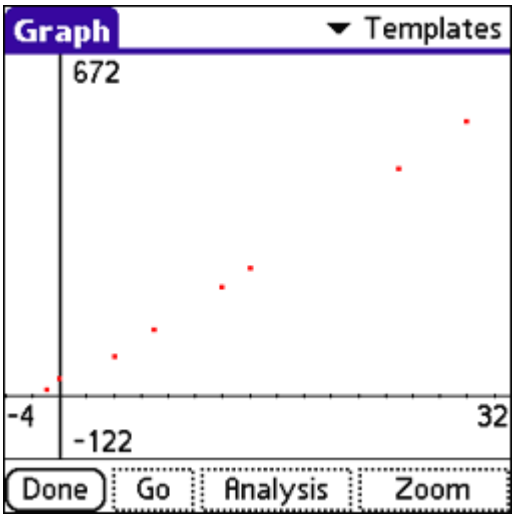
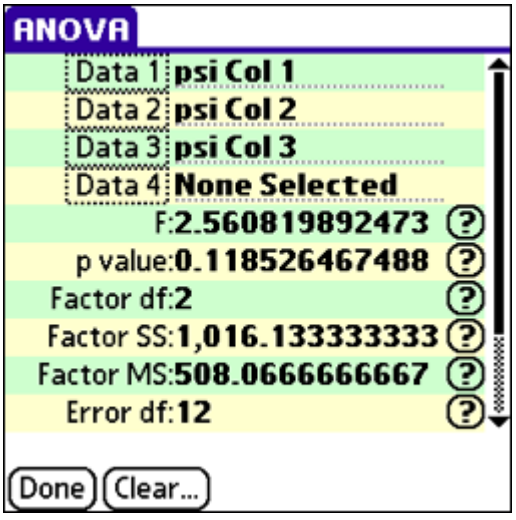


6.5.3 A-D

This section covers included templates beginning with the letters A through D.

6.5.3.1 ANOVA

This template is for one-way ANOVA tests. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.



Description
This template tests the equality of population means for 2 to 20 populations, assuming independent samples from normal populations with a common variance. The null hypothesis in this one-way analysis of variance is that all the population means are equal. The alternative is that at least two of the means differ from each other.

Variables

- **Data 1-20:** between 2 and 20 data sets are chosen for comparison.
- **F:** F-test statistic.
- **p:** probability value or observed significance level of the test.
- **Factor df:** factor (or treatment) degrees of freedom.
- **Factor SS:** factor (or treatment) sum of squares (SSTr).
- **Factor MS:** factor (or treatment) mean square (MSTr).
- **Error df:** error degrees of freedom.
- **Error SS:** error sum of squares (SSE).
- **Error MS:** error mean square (MSE).
- **Sxp:** pooled standard deviation.

Example

Given the following data:

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Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Data 1	{38; 56; 59; 64; 74}	
Data 2	{41; 63; 70; 72; 84}	
Data 3	{50; 31; 64; 36; 49}	
Data 4	None Selected	

Select "?" in the F row to calculate (may calculate automatically). The following answers are returned:

Variable	Calculated
F	2.5608
p value	0.1185
Factor df	2
Factor SS	1,016.13
Factor MS	508.07
Error df	12
Error SS	2,380.8
Error MS	198.4
Sxp	14.0855

6.5.3.2 Area

This template is for Area conversions. It is in the Convert category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Variables

- **Type #1:** the unit type to convert from.
- **Amount #1:** the amount of the first type.
- **Type #2:** the unit type to convert to.
- **Amount #2:** the amount of the second type.

Example

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If the map states that the land's area is 2 km^2, what is its area in acres?

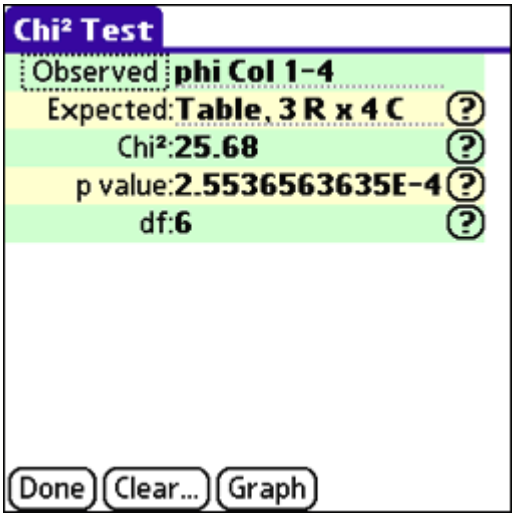
Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Type #1	Kilometers^2	Choose from the list
Amount #1	2	
Type #2	Acres	Choose from the list

Select "?" in the Amount #2 row to calculate (may calculate automatically). The area is 494.2 acres.

6.5.3.3 Chi-Squared Test

This template is for Chi^2 contingency table tests. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description
This template tests whether an association exists between the row and column categories in a two-way classification table. Often called a contingency table test, a test of independence or a test of homogeneity. The null hypothesis is that the row classification is not contingent on the column classification and vice versa. A matrix of expected values is generated assuming the null hypothesis is true.



Variables

- **Observed:** matrix (table) of observed values.
- **Expected:** matrix of expected values with the same dimensions as Observed.
- **Chi^2:** chi-square test statistic.
- **p value:** probability value or observed significance level of the test.
- **df:** degrees of freedom.

Graphing
To graph the test, select the "Graph" button. The graph displays the p-value as a shaded area of a chi distribution.

Example

Given the following data:

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Observed	{{20; 30; 25; 25}; {12; 18; 15; 5}; {18; 2; 10; 20}}	

Select "?" in the Expected row to calculate (may calculate automatically). The following answers are returned:

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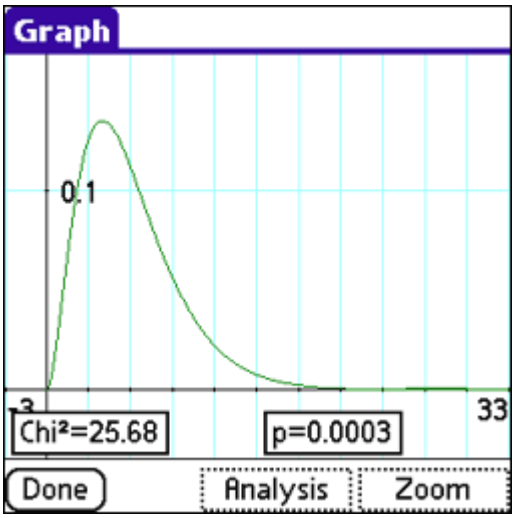
Variable	Calculated
Expected	{{ 25; 25; 25; 25}; {12.5; 12.5; 12.5; 12.5}; {12.5; 12.5; 12.5; 12.5}}
Chi^2	25.68
p value	2.5537e-4
df	6

The graph would appear as follows:

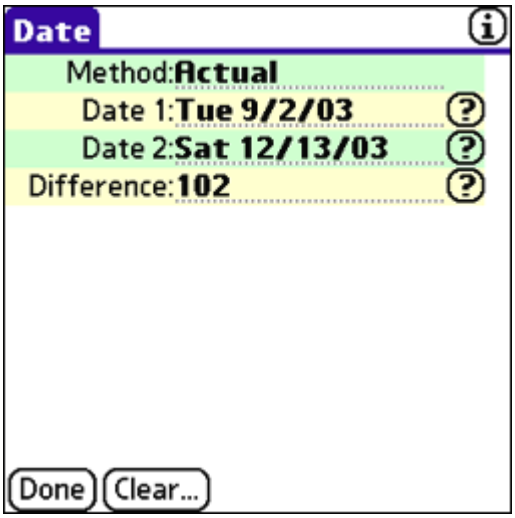


6.5.3.4 Date

This template is for Date calculations. It is in the Calendar category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Variables

- **Method:** the day-count method. Date arithmetic can be performed using an actual year, 30 day month/360 day year, actual/360 or actual/365 calendar.
  - Actual: counts the actual number of days in a month and the total number of days in a year, including leap years.
  - 30/360: treats all months as though they have 30 days and years as though they have 360 days.
  - Actual/360: counts the actual number of days in a month, but treats years as though they have 360 days.
  - Actual/365: counts the actual number of days in a month, but treats years as though they have 365 days.
- **Date 1:** the date to compute from.
- **Date 2:** to date to compute to.
- **Difference:** the difference in number of days.



Example

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Vacation begins on December 13, 2003. Today is September 2, 2003. How many actual days until vacation?

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Method	Actual	Choose from the list
Date 1	9/2/03	Enter September 2, 2003
Date 2	12/13/03	Enter December 13, 2003

Select "?" in the Difference row to calculate. There are 102 days until vacation.

6.5.3.5 Discount

This template is for Discount calculations. It is in the Business category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Variables

- **Price:** the price before discounts.
- **Sales Price:** the sales price after discount.
- **Discount%:** percentage discount. For example, a 30% discount would be entered as "30".

Example

The coupon is for 10% off the original cost. What is the discounted price if the cost is $9.99?

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Price	9.99	
Discount%	10	

Select "?" in the Price row to calculate. The sales price is $8.99.

6.5.4 E-M

This section covers included templates beginning with the letters E through M.

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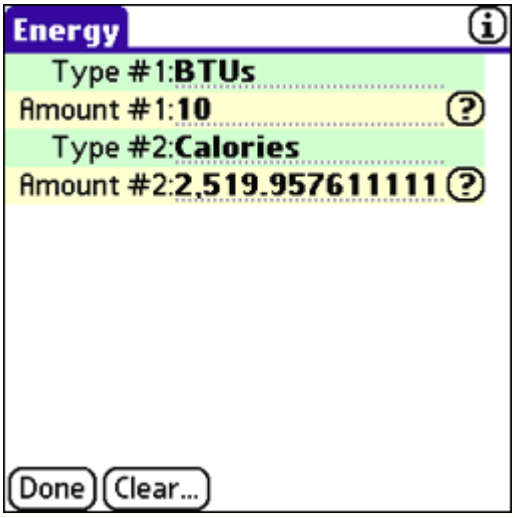
6.5.4.1 Energy

This template is for Energy conversions. It is in the Convert category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.



Variables

- **Type #1:** the unit type to convert from.
- **Amount #1:** the amount of the first type.
- **Type #2:** the unit type to convert to.
- **Amount #2:** the amount of the second type.

Example

The diet plan says it will help burn 10 BTUs per week. How many calories is this?

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Type #1	BTUs	Choose from the list
Amount #1	10	
Type #2	Calories	Choose from the list

Select "?" in the Amount #2 row to calculate (may calculate automatically). The conversion is 2,520 calories.

6.5.4.2 Force

This template is for Force conversions. It is in the Convert category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

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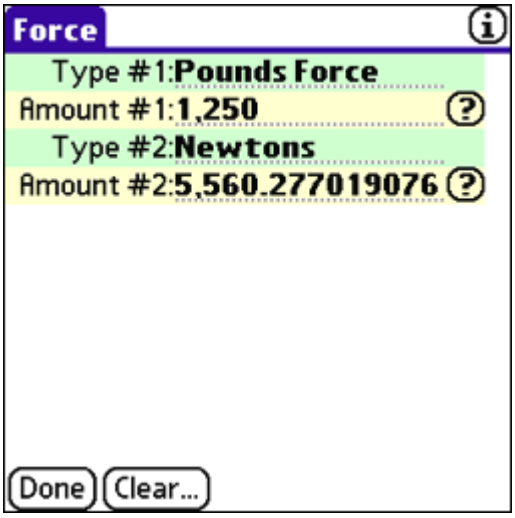


Variables

- **Type #1:** the unit type to convert from.
- **Amount #1:** the amount of the first type.
- **Type #2:** the unit type to convert to.
- **Amount #2:** the amount of the second type.

Example

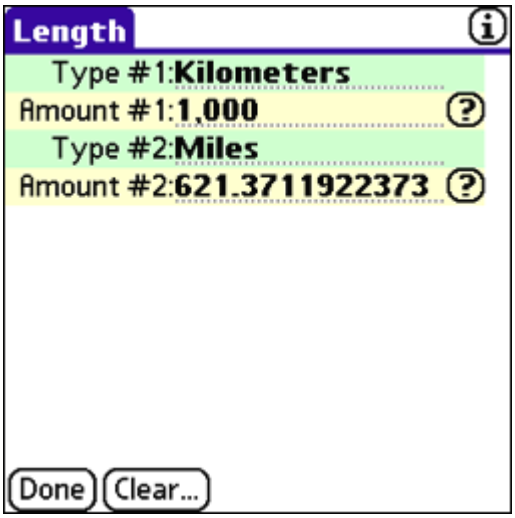
The manual says the machine exerts 1,250 pounds force. How many Newtons is this?

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Type #1	Pounds Force	Choose from the list
Amount #1	1250	
Type #2	Newtons	Choose from the list

Select "?" in the Amount #2 row to calculate (may calculate automatically). The conversion is 5,560.3 Newtons.

6.5.4.3 Length

This template is for Length conversions. It is in the Convert category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.



Variables

- **Type #1:** the unit type to convert from.
- **Amount #1:** the amount of the first type.
- **Type #2:** the unit type to convert to.
- **Amount #2:** the amount of the second type.

Example

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It is 1,000 kilometers from your home to your aunt's house. How many miles is this?

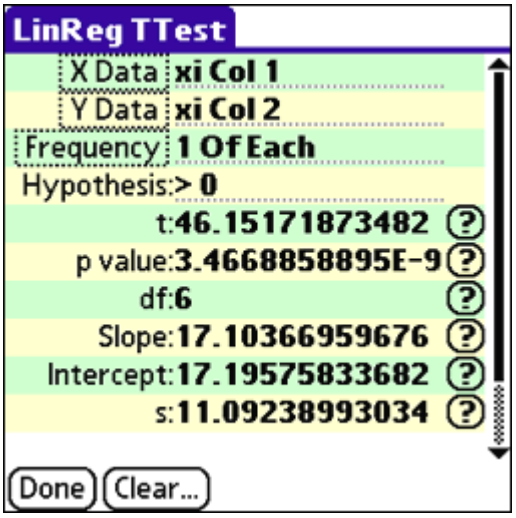
Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Type #1	Kilometers	Choose from the list
Amount #1	1000	
Type #2	Miles	Choose from the list

Select "?" in the Amount #2 row to calculate (may calculate automatically). The conversion is 621.4 miles.

6.5.4.4 Linear Regression T Test

This template is for linear regression *t* tests. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description
This template calculates the regression coefficients in a simple linear regression of y on x and tests for significant (non-zero) slope of the line or for significant (non-zero) correlation between y and x. The fitted equation is y = ax+b where a is the slope and b is the y-intercept. The null hypothesis is that there is no regression relationship (or correlation) between y and x, that the true slope is zero.



Variables

- **X Data:** x data set to analyze. Select the label to choose a table column or create a new one. Must have the same number of data points as Y Data and at least two observations.
- **Y Data:** y data set to analyze. Select the label to choose a table column or create a new one. Must have the same number of data points as X Data and at least two observations.
- **Frequency:** frequency list that correlates to both data sets. Select the label to choose a table column or create a new one. It defaults to 1 of Each.
- **Hypothesis:** the three possible alternative hypotheses are whether the slope and correlation coefficient are not equal to, less than or greater than 0.
- **t:** *t*-test statistic.
- **p value:** probability value or observed significance level.
- **df:** degrees of freedom.
- **Slope:** slope of the fitted equation.
- **Intercept:** y-intercept for the fitted equation.
- **s:** standard error of the residuals.
- **r^2:** simple coefficient of determination.
- **r:** simple correlation coefficient.

Example

Given the following data:

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Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Data 1	{-1; 0; 7; 12; 4; 14; 25; 30}	
Data 2	{10; 32; 128; 213; 75; 250; 446; 540}	
Frequency	1 Of Each	
Hypothesis	> 0	Choose from the list

Select "?" in the t row to calculate (may calculate automatically). The following answers are returned:

Variable	Calculated
t	46.1517
p value	3.4669e-9
df	6
Slope	17.1037
Intercept	17.1958
s	11.0924
r^2	0.9972
r	0.9986

6.5.4.5 Markup

This template is for Markup calculations. It is in the Business category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Variables

- **Method:** computation based on price or cost. Profit margin computations are based on price; percent change computations are based on cost.
- **Cost:** the cost to manufacture or purchase.
- Price: the selling or resale price.
- **Markup%:** the markup expressed as a percentage. For example, an 8.125% change would be entered as "8.125". A positive value represents an increase while a negative one represents a decrease.

Example

The clothing is sold at a 25% markup on cost. What is the price if the cost is $29.99?

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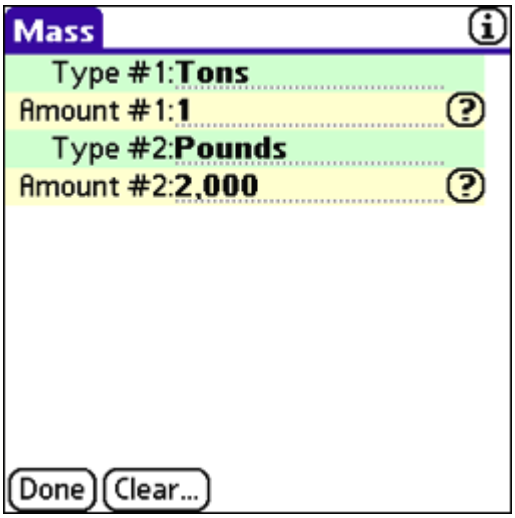
Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Method	% of Cost	Choose from the list
Cost	29.99	
Markup%	25	

Select "?" in the Price row to calculate. The price is $37.49.

6.5.4.6 Mass

This template is for Mass conversions. It is in the Convert category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.



Variables

- **Type #1:** the unit type to convert from.
- **Amount #1:** the amount of the first type.
- **Type #2:** the unit type to convert to.
- **Amount #2:** the amount of the second type.

Example

The elephant weighs 1 ton. How many pounds is this?

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Type #1	Tons	Choose from the list
Amount #1	1	
Type #2	Pounds	Choose from the list

Select "?" in the Amount #2 row to calculate (may calculate automatically). The elephant weighs 2,000 pounds.

6.5.5 N-S

This section covers included templates beginning with the letters N through S.

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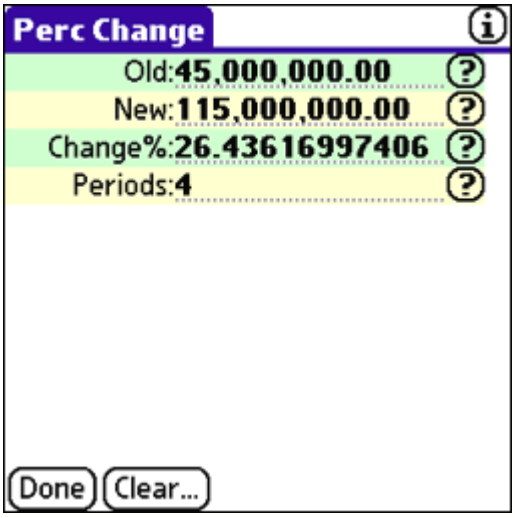
6.5.5.1 Percent Change

This template is for Percent Change calculations. It is in the Business category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.



Variables

- **Old:** the old value.
- **New:** the new value.
- **Change%:** the percentage changed per period. For example, an 8.125% change would be entered as "8.125". A positive value represents an increase while a negative one represents a decrease.
- **Periods:** the number of periods.

Example

Over 4 years, sales increased from $45 million to $115 million. The industry average is 20% increase per year. How does your company compare?

Variable	Entry	Comments
Tap the Clear… button		Sets the display to its default values
Old	45,000,000	
New	115,000,000	
Periods	4	

Select "?" in the Change% row to calculate. Sales have increased 26.44% per year, comparing favorably to the 20% industry pace.

6.5.5.2 Power

This template is for Power conversions. It is in the Convert category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

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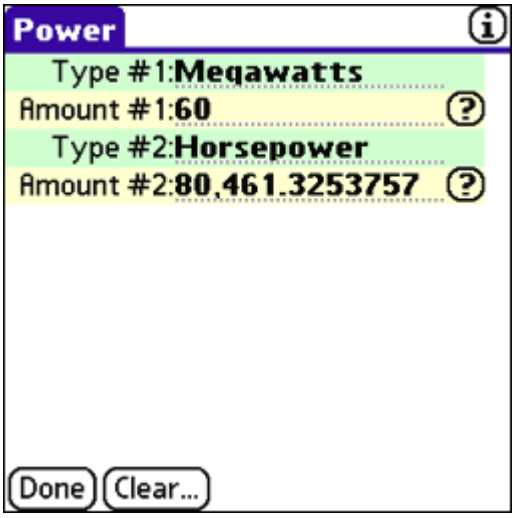


Variables

- **Type #1:** the unit type to convert from.
- **Amount #1:** the amount of the first type.
- **Type #2:** the unit type to convert to.
- **Amount #2:** the amount of the second type.

Example

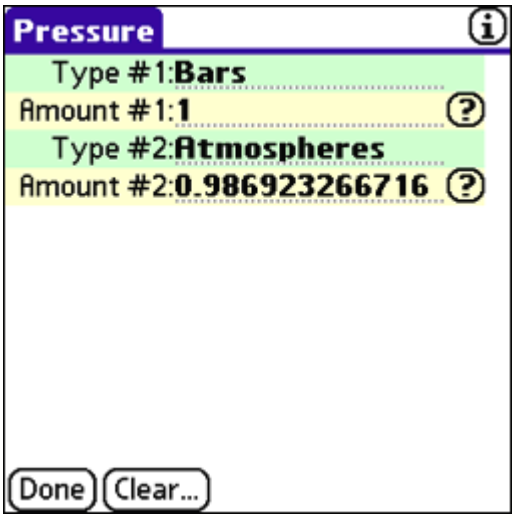
The engine uses 60 megawatts of power. What is the equivalent horsepower?

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Type #1	Megawatts	Choose from the list
Amount #1	60	
Type #2	Horsepower	Choose from the list

Select "?" in the Amount #2 row to calculate (may calculate automatically). The conversion is 80,461.3 horsepower.

6.5.5.3 Pressure

This template is for Pressure conversions. It is in the Convert category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.



Variables

- **Type #1:** the unit type to convert from.
- **Amount #1:** the amount of the first type.
- **Type #2:** the unit type to convert to.
- **Amount #2:** the amount of the second type.

Example

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How many atmospheres in a bar?

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Type #1	Bar	Choose from the list
Amount #1	1	
Type #2	Atmospheres	Choose from the list

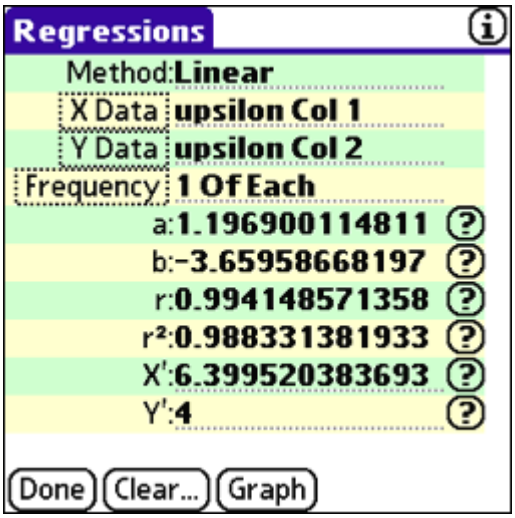
Select "?" in the Amount #2 row to calculate (may calculate automatically). There are .987 atmospheres per bar.

6.5.5.4 Regressions

This template is for regression model analysis. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description
This template fits any of several different linear and curvilinear regression models to a set of paired observations (x, y).

Variables



- **Method:** regression method. See details below.
- **X Data:** x data set to analyze. Select the label to choose a table column or create a new one. x is the independent or predictor variable.
- **Y Data:** y data set to analyze. Select the label to choose a table column or create a new one. y is the dependent or response variable.
- **Frequency:** frequency list that correlates to both data sets. Select the label to choose a table column or create a new one. It defaults to 1 of Each.
- **a-e:** values of the regression coefficients in the fitted equation. Only those applicable to selected regression model will appear in the template.
- **r:** simple correlation coefficient.
- **r^2/R^2:** coefficient of determination (simple, multiple).
- **X':** a selected x value.
- **Y':** predicted y value corresponding to X'. May not calculate for all models.

Regression Models
In general, it is always best to have as much data as possible when curve fitting.

- **Linear:** y = ax + b; a is the slope and b is the y-intercept.
- **Log (natural):** y = a + b * ln(x), for x > 0.
- **Log (base 10):** y = a + b * log(x), for x > 0.
- **Exponential:** $y = ab^x$
- **Power:** $y = ax^b$
- **Quadratic:** $y = ax^2 + bx + c$; three data points means polynomial fit while more than three is defined as polynomial regression.
- **Cubic:** $y = ax^3 + bx^2 + cx + d$; four data points means polynomial fit while more than four is defined as polynomial regression.
- **Quartic:** $y = ax^4 + bx^3 + cx^2 + dx + e$; five data points means polynomial fit while more than five is defined as polynomial regression.

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- **Logistic:** $y = c / (1 + a * e^{-bx})$
- **Sinusoidal:** y = a * sin(bx + c) + d; at least two data points per cycle is suggested for reliable results.
- **Med-Med:** y = ax + b using median-median method; a is the slope and b is the y-intercept.

Graphing
To graph the test, select the "Graph" button. The graph displays a scatter plot of (x, y) points along with the fitted curve.

Example

Given the following data:

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Method	Linear	Choose from the list
X Data	{38; 56; 59; 64; 74}	
Y Data	{41; 63; 70; 72; 84}	
Frequency	1 Of Each	

Select "?" in the a row to calculate (may calculate automatically). The following answers are returned:

Variable	Calculated
a	1.1969
b	-3.6596
r	0.9941
r^2	0.9883

To calculate predictive values:

Variable	Enter	Comments
Y'	4	

Select "?" in the X' row to calculate (may calculate automatically). The following answers are returned:

Variable	Calculated
X'	6.3995

The graph would appear as follows:

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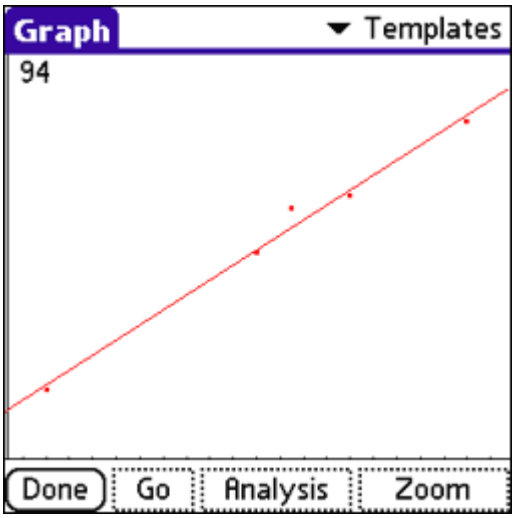

6.5.5.5 Sales Tax

This template is for Sales Tax calculations. It is in the Business category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Variables

- **Before Tax:** before tax amount.
- **Tax Rate%:** tax rate expressed as a percentage. For example, a 6% tax rate would be entered as "6".
- **After Tax:** after tax amount.

Example

Dinner for two cost $39.96 before taxes. What is the bill after taxes if the tax rate is 7.25%?

Variable	Entry	Comments
Tap the Clear… button		Sets the display to its default values
Before Tax	39.96	
Tax Rate%	7.25	

Select "?" in the After Tax row to calculate. The bill after taxes is $42.86.

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6.5.6 T

This section covers included templates beginning with the letter T.

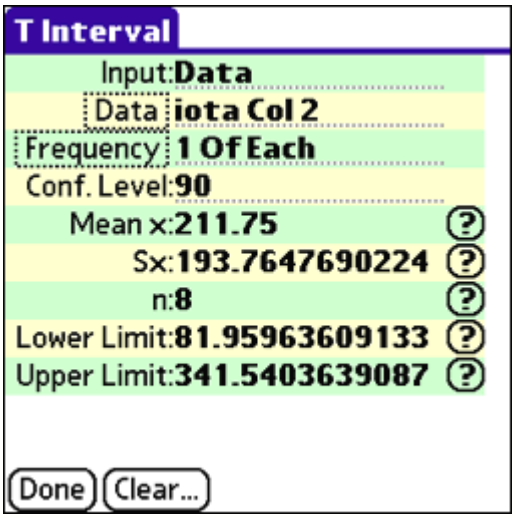
6.5.6.1 T Confidence Interval, One-Sample

This template is for one-sample *t* confidence intervals for a population mean. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description
This template calculates a confidence interval for an unknown population mean (Mean,p) based on a random sample from a normal population with unknown standard deviation. The available variables depend on whether data or stats are used to perform the calculation (designated by variable "Input"). The stats option is used to directly enter values of the sample statistics; the data option is selected if the sample statistics are to be computed from the data.

Variables

- **Input:** whether data or statistics are used to compute the appropriate values.
- **Data:** data set to analyze. Select the label to choose a table column or create a new one.
- **Frequency:** frequency list for the data set. Select the label to choose a table column or create a new one. It defaults to 1 of Each.
- **Conf Level:** confidence coefficient entered as a percentage (0-100) or as a decimal (0-1).
- **Mean X:** sample mean of x values.
- **Sx:** sample standard deviation of x values.
- **n:** number of observations in the data set. Must be a positive integer number.
- **Lower Limit:** lower *t* confidence limit for Mean,p.
- **Upper Limit:** upper *t* confidence limit for Mean,p.



Example

Given the following data:

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Input	Data	Choose from the list
Data	{10; 32; 128; 213; 75; 250; 446; 540}	
Frequency	1 Of Each	
Conf. Level	90	

Select "?" in the Mean x row to calculate (may calculate automatically). The following answers are returned:

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Variable	Calculated
Mean x	211.75
Sx	193.7648
n	8
Lower Limit	81.9596
Upper Limit	341.5404

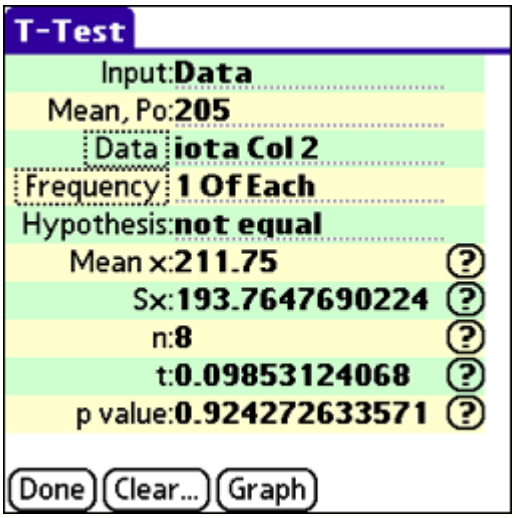
6.5.6.2 T Test, One-Sample

This template is for one-sample *t* tests about a population mean. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description
This template tests a hypothesis about the value of an unknown population mean (Mean,p) based on a random sample from a normal population with unknown standard deviation. The null hypothesis is that Mean,p = Mean,Po for a specified value of Mean,Po. The available variables depend on whether data or stats are used to perform the calculation (designated by variable "Input"). The stats option is used to directly enter values of the sample statistics; the data option is selected if the sample statistics are to be computed from the data.

Variables

- **Input:** whether data or statistics are used to compute the appropriate values.
- **Mean,Po:** the hypothesized value of the population mean.
- **Data:** data set to analyze. Select the label to choose a table column or create a new one.
- **Frequency:** frequency list for the data set. Select the label to choose a table column or create a new one. It defaults to 1 of Each.
- **Hypothesis:** the three possible alternative hypotheses are Mean,p not equal Mean Po; Mean,p > Mean Po; or Mean,p < Mean Po.
- **Mean X:** sample mean of x values.
- **Sx:** sample standard deviation of x values. Must be a positive integer or floating point number.
- **n:** number of observations in the data set. Must be a positive integer number.
- **t:** *t*-test statistic.
- **p value:** probability value or observed significance level of the test.



Graphing
To graph the test, select the "Graph" button. The graph displays the p-value as a shaded area of a t distribution.

Example

Given the following data:

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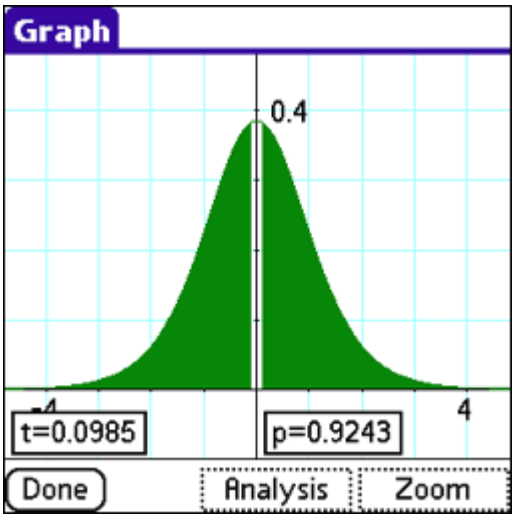
Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Input	Data	Choose from the list
Mean,Po	205	
Data	{10; 32; 128; 213; 75; 250; 446; 540}	
Frequency	1 Of Each	
Hypothesis	not equal	

Select "?" in the Mean x row to calculate (may calculate automatically). The following answers are returned:

Variable	Calculated
Mean x	211.75
Sx	193.7648
n	8
t	0.0985
p value	0.9243

The graph would appear as follows:



6.5.6.3 Temperature

This template is for Temperature conversions. It is in the Convert category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

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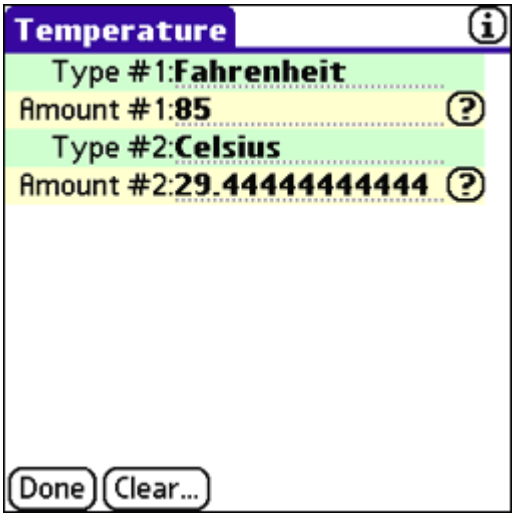

Variables

- **Type #1:** the unit type to convert from.
- **Amount #1:** the amount of the first type.
- **Type #2:** the unit type to convert to.
- **Amount #2:** the amount of the second type.

Example

If the temperature is 85 degrees Fahrenheit, what is the equivalent in degrees Celsius?

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Type #1	Fahrenheit	Choose from the list
Amount #1	85	
Type #2	Celsius	Choose from the list

Select "?" in the Amount #2 row to calculate (may calculate automatically). It is 29.4 degrees Celsius.

6.5.6.4 Time

This template is for Time calculations. It is in the Calendar category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description

Use this template to calculate the difference between two times or sum two times. Times are displayed in either standard (am/pm) or 24-hour format, depending on the localized time format set in the device's system settings (see your device manual for details).

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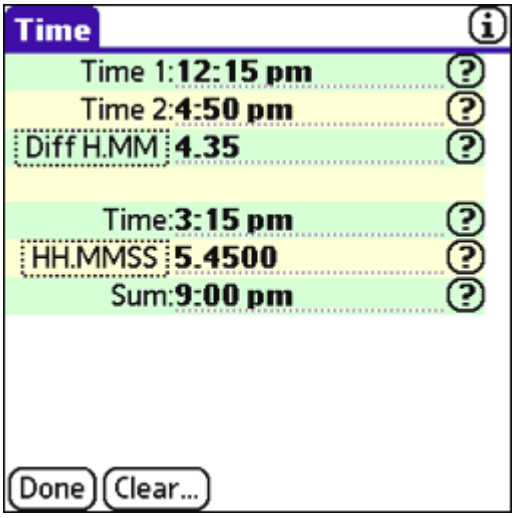
Variables
The top section of the template performs time difference calculations:

- **Time 1:** the beginning time set in increments of 5 minutes.
- **Time 2:** the ending time set in increments of 5 minutes.
- **Diff H.MM/Diff Hrs:** the difference between the two times. "Diff H.MM" displays in hour-minute format (5 hrs, 45mins would display as 5.45). "Diff Hrs" displays as fraction of an hour.

The bottom section performs time addition calculations:

- **Time:** starting time.
- **HH.MMSS/HrsFrac:** time duration. "HH.MMSS" displays time in hour, minute, second format (4hrs, 7mins, 30sec would display as 4.0730). "Hrs.Frac" displays time as a fraction of an hour.
- **Sum:** the end time.



Example

Time Difference: A project began at 12:15pm and concluded at 4:50pm. How much time was spent on the project?

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Time 1	12:15pm	
Time 2	4:50pm	

Make sure Diff Hrs is showing instead of Diff H.MM. Select "?" in the Diff Hrs row to calculate. This project took 4.5833 hours (4 hours, 35 minutes).

Time Sum: If you start driving at 3:15 pm and the trip will take 5hrs, 45mins, what time will you arrive?

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Time	3:15 pm	
H.MMSS	5.45	

Select "?" in the Sum row to calculate. You will arrive at 9:00pm.

6.5.6.5 Tip

This template is for Tip and bill splitting calculations. It is in the Business category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

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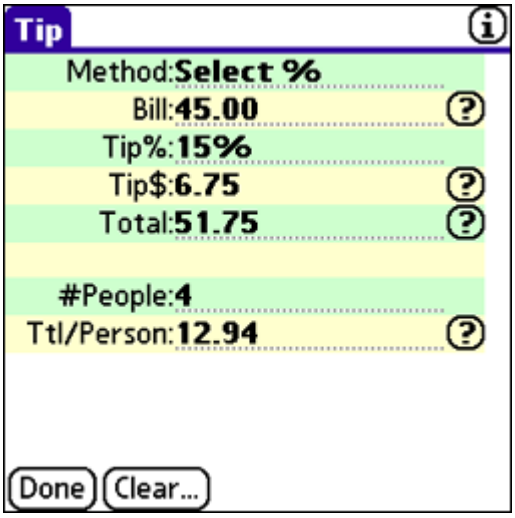
Variables

- **Method:** the calculation method. Choose "Select%" to select a tip percentage from a list, choose "Enter%" to enter the tip's percentage as a number or choose "Enter$" enter the tip's amount.
- **Bill:** the bill amount before tip.
- **Tip%:** tip amount entered or calculated as a percentage.
- **Tip$:** tip amount entered or calculated as an amount.
- **Total:** the total amount including the tip.
- **#People:** the number of people paying for the meal.
- **Ttl/Person:** the total per person, split evenly among the people paying for the meal.



The tip computation calculates from the top, down. In other words, to calculate the tip amount, it will first attempt to use Bill, then Total, and finally Ttl/Person to calculate. It knows to use a value when the variable is not zero. If Bill is 0, for example, it will use Total.

Example

A lunch bill for four friends is $45. With a 15% tip, what is the total bill amount how much should each person contribute?

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Bill	45	
Tip%	15	
#People	4	

Select "?" in the Tip$ and Total rows to calculate the tip amount and total amount, respectively, and select "?" in the Ttl/Person row to calculate the amount per person. The total is $51.75 and each person should contribute $12.94.

6.5.6.6 TVM (Time Value of Money)

This template is for TVM (Time Value of Money) calculations. It is in the Business category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description

Time value of money is the process of earning compound interest over a period of time. Compound interest problems assume that the interest earned also earns interest. Computations such as loans, leases, mortgages, annuities, and savings accounts are examples of compound interest problems.

In time value problems, positive and negative numbers have different meanings: positive numbers are inflows of cash (cash received) while negative numbers are outflows (cash paid). A car loan, for instance, may have a positive present value (because money was received from the loan company) but will have a negative payment amount, since this is money that will be paid back to the loan company.

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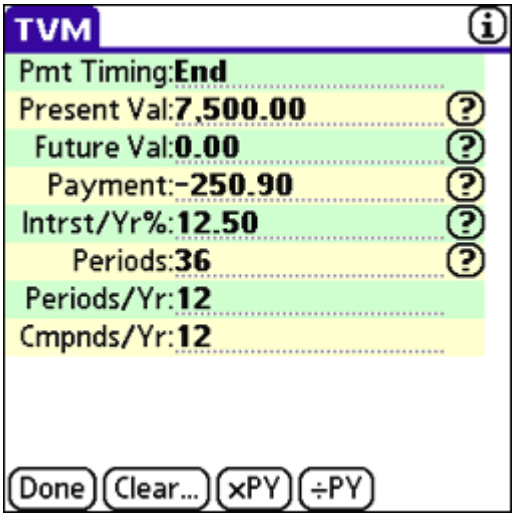
Variables



- **Pmt Timing:** the payment timing. Payments occur at the beginning or end of the period. Payments made at the beginning of the period are called Annuity Due. Most leases are this kind. A payment made at the end of the period is called an Ordinary Annuity. Most loans are this kind.
- **Present Val:** the present value.
- **Future Val:** the future value.
- **Payment:** payment amount per period.
- **Intrst/Yr%:** interest per year as a percentage. For example, 8.25% interest should be entered as "8.25".
- **Periods:** number of total periods. This number is the number of years and months times the periods per year. For example, if the loan is 4 years with 12 payments per year (monthly payments), periods should be 48 (4 x 12).
- **Periods/Yr:** the number of payment periods per year. For example, if payments are made quarterly, periods per year should be 4.
- **Cmpnds/Yr:** the number of interest compounding periods per year. Most of the time, compounding periods per year should equal payment periods per year. For example, if payments are made monthly and interest is compounded monthly, compounding periods per year and periods per year should both be 12.

Buttons

- **xPY:** quick set button for the number of periods. This button multiplies the value in periods by the value in periods per year. For example, to convert 10 years at 12 periods per year to periods, enter 10 in period s, 12 in periods per year, and select xPY.
- **÷PY:** quick set button for the number of periods. This button divides the value in periods by the value in periods per year. For example, if periods is 60 with periods per year equal to 12, discovering that it is equal to five years can be done easily by selecting ÷PY.

Examples

Car Loan: When purchasing a new car, the auto dealer has offered a 12.5% interest rate over 36 months on a $7,500 loan. What will be the monthly payment?

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Pmt Timing	End	Loan pmt's are at the end of the period. Choose from the list
Present Val	7500	
Intrst/Yr%	12.5	
Periods	36	3 years at 12 periods per year
Periods/Yr	12	
Cmpnds/Yr	12	

Select "?" in the Payment row to calculate. The payment will be –250.90 per month. It is negative because it is a cash outflow.

Retirement Annuity: With 35 years until retirement and $15,000 in the bank, it is time to think about savings. How much would have to be put aside at the beginning of each month to reach $2.5 million if an interest rate of 10% can be expected.

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Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Pmt Timing	Begin	Choose from the list
Present Val	-15,000	Negative because cash out of hand
Future Val	2,500,000	Positive because future cash inflow
Intrst/Yr%	10.0	
Periods	420	35 years x 12 periods per year
Periods/Yr	12	
Cmpnds/Yr	12	

Select "?" in the Payment row to calculate. The payment amount is –525.15 per month. It is negative because it is a cash outflow.

Savings Account: With $3,000 in a savings account and 3.75% interest, how many months does it take to reach $4,000?

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Pmt Timing	End	Choose from the list
Present Val	-3,000	Negative because cash deposit (outflow) to open account
Future Val	4,000	
Payment	0	
Intrst/Yr%	3.75	
Periods/Yr	12	
Cmpnds/Yr	12	

Select "?" in the Periods row to calculate. To reach $4,000, it will take 92.20 periods (or 92.20 ¸ 12 = 7.68 years).

Home Mortgage: You have decided to buy a house but you only have $900 to spend each month on a 30-year mortgage. The bank has quoted an interest rate of 8.75%. What is the maximum purchase price?

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Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Pmt Timing	End	Loans payments at the end of the period. Choose from the list
Future Val	0	
Payment	-900	Negative because cash outflow
Intrst/Yr%	8.75	
Periods	360	30 years at 12 periods per year
Periods/Yr	12	
Cmpnds/Yr	12	

Select "?" in the Present Val row to calculate. You can afford a home with a price of $114,401.87.

Mortgage with a Balloon Payment: (Continued from Home Mortgage) You realize that you will only own the house for about 5 years and then sell it. How much will the balloon payment (the repayment to the bank) be?

Variable	Enter	Comments
Periods	60	5 years at 12 periods per year

Select "?" in the Future Val row to calculate. The balloon payment will be $109,469.92 after five years.

Canadian Mortgage: Canadian mortgages compound interest twice per year instead of monthly. What is the monthly payment to fully amortize a 30-year, $80,000 Canadian mortgage if the interest rate is 12%?

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Pmt Timing	End	Loans payments at the end of the period. Choose from the list
Present Val	80,000	Positive because cash inflow
Future Val	0	
Intrst/Yr%	12.00	
Periods	360	30 years at 12 periods per year
Periods/Yr	12	
Cmpnds/Yr	2	

Select "?" in the Payment row to calculate. The payment will be –$805.11. It is negative because it is a cash outflow.

Bi-Weekly Mortgage Payments: A buyer is considering a $100,000 home loan with monthly payments, an annual interest rate of 9% and a term of 30 years. Instead of making monthly payments, the buyer realizes that he can build equity faster by making bi-weekly payments (every two weeks). How long will it take to pay off the loan?

Part 1: Calculate the monthly payment

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Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Pmt Timing	End	Choose from the list
Present Val	100,000	
Future Val	0	
Intrst/Yr%	9.00	
Periods	360	30 years at 12 periods per year
Periods/Yr	12	
Cmpnds/Yr	12	

Select "?" in the Payment row to calculate. Calculating shows payment equal to –$804.62. It is negative because it is a cash outflow.

Part 2: Periods when making bi-weekly payments (continued)

Variable	Enter	Comments
Payment	-402.31	Recall payment in the input screen and divide it by 2
Periods/Yr	26	Bi-weekly payments mean 26 per year
Cmpnds/Yr	12	Still compounding interest monthly

Select "?" in the Periods row to calculate. Calculating shows periods equal to 567.40 periods (567.40 ¸ 26 = 21.82 years).

APR of a Loan with Fees: The Annual Percentage Rate (APR) is the interest rate when fees are included with the mortgage amount. Because the fees increase the cost of the loan, the effective interest rate on the borrowed amount is higher. For example, a borrower is charged two points for the issuance of a mortgage (one point is equal to 1% of the mortgage amount). If the mortgage amount is $60,000 for 30 years with an interest rate of 11.5%, what is the APR?

Part 1: Calculate the actual monthly payment

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Pmt Timing	End	Choose from the list
Present Val	60,000	
Future Val	0	
Intrst/Yr%	11.5	
Periods	360	30 years at 12 periods per year
Periods/Yr	12	
Cmpnds/Yr	12	

Select "?" in the Payment row to calculate. Calculating shows payment equal to –$594.17. It is negative because it is a cash outflow.

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Part 2: Calculate the APR (continued)

Variable	Enter	Comments
Present Val	58,800	The loan amount less 2% in fees. Calculate in the input screen with 60000 [x] .02 [=] [+/–] [+] 60000 [=]

Select "?" in the Intrst/Yr% row to calculate. Calculating shows interest per year equal to 11.76%.

Present Value of a Lease with Advance Payments and an Option to Buy: With a lease, often there is an amount to be paid up-front and an option to buy at the back-end. A company is leasing a machine for 4 years. Monthly payments are $2,400; an additional $2,400 payment at the beginning of the leasing period replaces the final payment. The leasing agreement includes an option to buy the machine for $15,000 at the end of the leasing period. What is the capitalized value of the lease, assuming that the interest rate paid to borrow the funds is 18% compounded monthly?

Part 1: Find the present value of the payments

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Pmt Timing	Beg	Choose from the list
Future Val	0	
Payment	–2,400	
Intrst/Yr%	18.00	
Periods	47	4 years at 12 per year less 1 advance payment
Periods/Yr	12	
Cmpnds/Yr	12	

Select "?" in the Present Val row to calculate. Calculating shows present value equal to $81,735.58. Recall this to the pop-up calculator and save it to memory.

Part 2: Present Value of the buy option (continued)

Variable	Enter	Comments
Future Val	–15,000	
Payment	0	
Periods	48	

Select "?" in the Present Val row to calculate. Calculating shows present value equal to $7,340.43.

Part 3: Calculate (continued)

Recall the present value to the pop-up calculator by selecting the Present Value's amount. Add it the present value of the payments stored in memory and $2,400 for the advanced payment. The answer is $91,476.00.

6.5.7 U-Z

This section covers included templates beginning with the letters U through Z.

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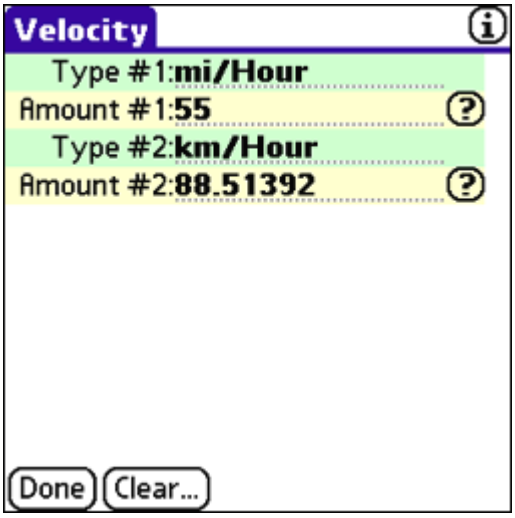
6.5.7.1 Velocity

This template is for Velocity conversions. It is in the Convert category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.



Variables

- **Type #1:** the unit type to convert from.
- **Amount #1:** the amount of the first type.
- **Type #2:** the unit type to convert to.
- **Amount #2:** the amount of the second type.

Example

A car traveling 55 mph is what velocity if measured in kilometers per hour?

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Type #1	mi/Hour	Choose from the list
Amount #1	55	
Type #2	km/Hour	Choose from the list

Select "?" in the Amount #2 row to calculate (may calculate automatically). The car is traveling 88.5 km/hr.

6.5.7.2 Volume

This template is for Volume conversions. It is in the Convert category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

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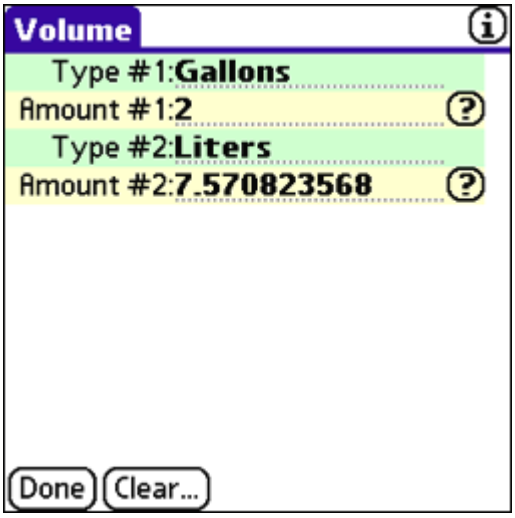

Variables

- **Type #1:** the unit type to convert from.
- **Amount #1:** the amount of the first type.
- **Type #2:** the unit type to convert to.
- **Amount #2:** the amount of the second type.

Example

For athletics, the coaches suggest drinking 2 gallons of water a day. How much water is this in Liters?

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Type #1	Gallons	Choose from the list
Amount #1	2	
Type #2	Liters	Choose from the list

Select "?" in the Amount #2 row to calculate (may calculate automatically). The answer is 7.6 Liters of water.

6.5.7.3 Z Confidence Interval, One-Sample

This template is for one-sample *z* confidence intervals for a population mean. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description

This template calculates a confidence interval for an unknown population mean (Mean,p) based on a random sample from a population with known standard deviation. The available variables depend on whether data or stats are used to perform the calculation (designated by variable "Input"). The stats option is used to directly enter values of the sample statistics; the data option is selected if the sample statistics are to be computed from the data.

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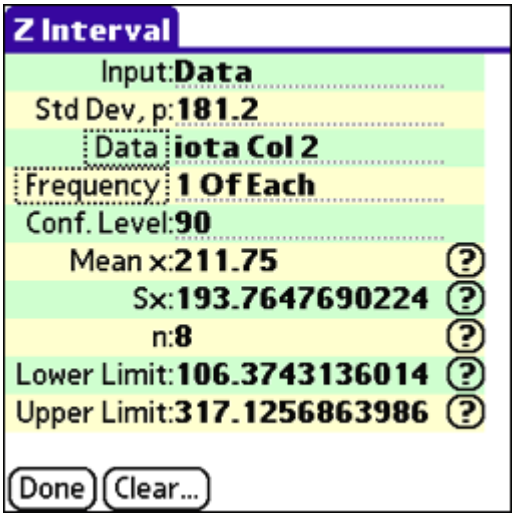
Variables

- **Input:** whether data or statistics are used to compute the appropriate values.
- **Std Dev,p:** population standard deviation. Must be a positive integer or floating point number.
- **Data:** data set to analyze. Select the label to choose a table column or create a new one.
- **Frequency:** frequency list for the data set. Select the label to choose a table column or create a new one. It defaults to 1 of Each.
- **Conf Level:** confidence coefficient entered as a percentage (0-100) or as a decimal (0-1).
- **Mean x:** sample mean of x values.
- **Sx:** sample standard deviation of x values.
- **n:** number of observations in the data set. Must be a positive integer number.
- **Lower Limit:** lower *z* confidence limit for Mean,p.
- **Upper Limit:** upper *z* confidence limit for Mean,p.



Example

Given the following data:

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Input	Data	Choose from the list
Std Dev,p	181.2	
Data	{10; 32; 128; 213; 75; 250; 446; 540}	
Frequency	1 Of Each	
Conf. Level	90	

Select "?" in the Mean x row to calculate (may calculate automatically). The following answers are returned:

Variable	Calculated
Mean x	211.75
Sx	193.7648
n	8
Lower Limit	106.3743
Upper Limit	317.1257

6.5.7.4 Z Test, One-Sample

This template is for one-sample *z* tests about a population mean. It is in the Stats category. For information on accessing this template, see the Templates : Accessing section. For more on using templates in general, see the Templates : Using the Templates section.

Description

This template tests a hypothesis about the value of an unknown population mean, Mean,p, based on a random sample

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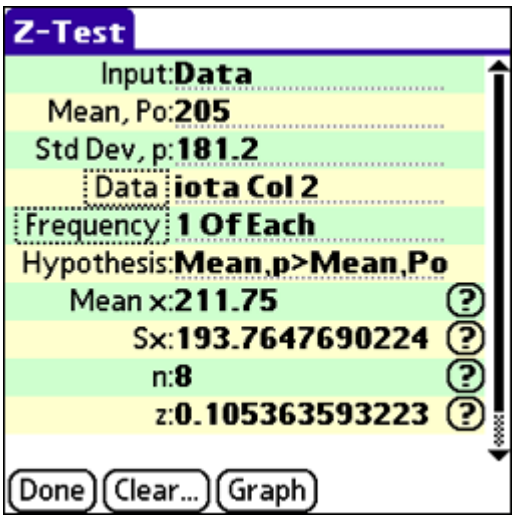
from a population with known standard deviation. The null hypothesis is that Mean,p = Mean,Po for a specified value of Mean,Po. The available variables depend on whether data or stats are used to perform the calculation (designated by variable "Input"). The stats option is used to directly enter values of the sample statistics; the data option is selected if the sample statistics are to be computed from the data.



Variables

- **Input:** whether data or statistics are used to compute the appropriate values.
- **Mean,Po:** the hypothesized value of the population mean.
- **Std Dev,p:** population standard deviation. Must be a positive integer or floating point number.
- **Data:** data set to analyze. Select the label to choose a table column or create a new one.
- **Frequency:** frequency list for the data set. Select the label to choose a table column or create a new one. It defaults to 1 of Each.
- **Hypothesis:** the three possible alternative hypotheses are Mean,p not equal Mean,Po; Mean,p > Mean,Po; or Mean,p < Mean,Po.
- **Mean x:** sample mean of x values.
- **Sx:** sample standard deviation of x values.
- **n:** number of observations in the data set. Must be a positive integer number.
- **z:** *z*-test statistic.
- **p value:** probability value or observed significance level of the test.

Graphing

To graph the test, select the "Graph" button. The graph displays the p-value as a shaded area of a standard normal distribution.

Example

Given the following data:

Variable	Enter	Comments
Tap the Clear… button		Sets the display to its default values
Input	Data	Choose from the list
Mean,Po	205	
Std Dev,p	181.2	
Data	{10; 32; 128; 213; 75; 250; 446; 540}	
Frequency	1 Of Each	
Hypothesis	Mean,p > mean,Po	Choose from the list

Select "?" in the Mean x row to calculate (may calculate automatically). The following answers are returned:

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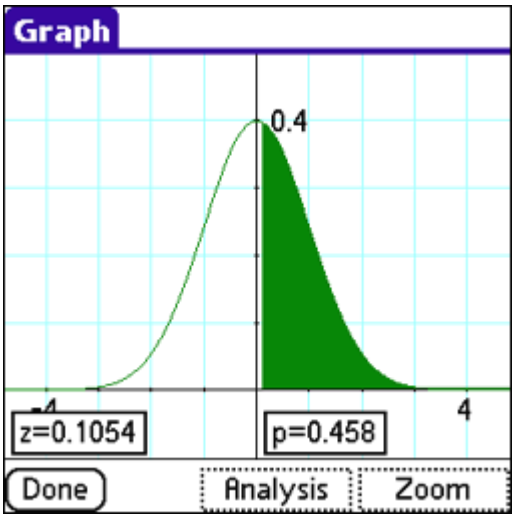
Variable	Calculated
Mean x	211.75
Sx	193.7648
n	8
z	0.1054
p value	0.4580

The graph would appear as follows:



6.6 Creating Templates

To create a template from the main calculator, select the Template button (third from left) and choose "New Template" at the bottom of the list. To create a template from My Templates, select "New". Once created, these templates are accessed the same as templates that are included with the software. See Templates : Accessing for more information.

A. Name: template's name.

B. Equation: template's equation. See the Using the Solver section for more information about writing solver equations. Single equation templates are available. See the Solver Limitations section for more information.

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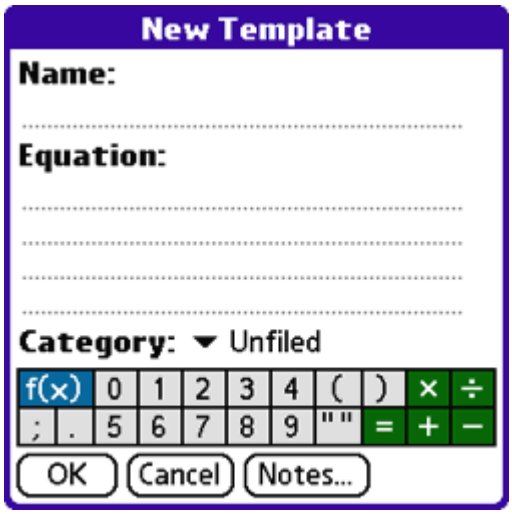
C. Category: templates are sorted into categories. Choose a category from the list or select "New Category" to create a new one. Categories only exist as long as there are templates in them. To delete a category, move all the templates in that category to another category or delete all templates in that category.



D. Keypad: keypad for easy entry. "f(x)" displays the list of functions organized by category. This is the same as the main calculator's list except function "solving" is available in category Boolean (bool) and category MEM is added (memory store, recall and clear options). Template creation "=" is different than "=" in the main calculator. See the Using the Solver category for more information. See the Functions section for more on each available function. See the Using the Calculator : Memory & Storage : Memory Locations section for more on recall and store.

E. Buttons: "OK" saves changes while "Cancel" deletes changes, returning to My Data. To enter notes about the template, select "Notes".

6.6.1 Using the Solver

An equation is in the form a = b where a and b are combinations of variables, constants, operators and functions. The following equation will be used for reference:

Area = sin(Width/45) * Length

An equation is made of four components:

Variables: the names of items that are either stored or calculated. In the example above, Area, Width and Length are variables.

These variables must consist of letters (capital or lower case 'a' through 'z') and numbers (0 through 9) with a maximum of 11 characters. The variable cannot start with a number. Note that the percentage symbol (%) is a mathematical symbol and cannot be used in the name of a variable. (The built-in templates are able to use a label to represent the variable in the template view and the label is not subject to the same restrictions as a variable's name.)

Constants: these are values that do not change. In the example above, 45 is a constant.

Do not use digit separators (such as commas or spaces). For decimal separators, use the setting defined in the system's Preferences and indicated as the decimal separator button (either point or comma). Use the keypad to enter these.

Operators: mathematical symbols such as plus, minus, times and divide. In the example above, both multiple (*) and divide (/) are operators.

Functions: allows for more advanced mathematical capabilities, which are built into the calculator. In the example above, sine (sin) is a function.

Select the "f(x)" button on the keypad to access a list of functions sorted by category. See the Function section for more information about each.

Additional notes on entering equations:

- The solver follows order of operations precedence. To override order of operations or in cases where order of operations is uncertain, use parentheses in the formula.
- Spaces are ignored. Often, when the equation is strung together on the screen without any spaces, it is difficult to see. Use spaces to help view equations.
- There is no implied multiplication. If an equation shows "z (1 + h)", that needs to be entered as "z * (1 + h)".
- Often an either/or situation exists when performing a calculation. "If" statements are used to express these

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relationships.

6.6.2 How the Solver Works

There are two kinds of solving: iterative and symbolic. Infinity Softworks' solver uses an iterative approach.

An iterative method attempts to balance an equation and determine an answer, relying on a minimum and maximum guess to "bracket" the answer. An equation is said to be in balance when, tabulated, the value to the left of the equals sign is the same as the value to the right of the equals sign.

In its simplest form, an iterative solver determines a mid-point between a maximum and minimum guess and evaluates the equation at all three points. It then decides which two points the equation is between – the mid-point and minimum guess or mid-point and maximum guess – and calculates a new mid-point based on those two points. It continues this cycle until it "guesses" the right answer. Although the solver is more advanced than this, it is similar in nature.

Generally, calculations are completed in less than a second. If the calculation is more complicated, however, a Computing dialog will appear. Guesses made by the solver flash on the screen. If the "Cancel" button is selected, the answer will return as the last guess.

To speed execution and increase the likelihood of an answer, change the max and min range settings in the Variable Preferences. See the Using the Templates : Variable Preferences section for more information. In some cases, the solver can calculate an answer directly without iterating to an answer. In this case, max and min range settings are not available.

6.6.3 Solver Limitations

Certain functionality offered with included templates is not available with solver created ones. Commonly requested one are listed here:

- **Data entry:** only numbers (Booleans, Integers and Floating Point Numbers) can be entered into a template, although dates (dd.mmyyyy) and times (hh.mmssmmm) can be entered in number formats. Other data types can be used in the equation but cannot be entered.
- **Multiple equations:** templates are designed to work with single equations only, although multiple equations can be derived by using choose, if and solving in the equation. See the Templates : Creating Templates : Examples section for more information.
- **Buttons:** there is no mechanism for creating buttons next to Done and Clear.
- **Pop-up Lists:** there is no mechanism for creating pop-up lists.

6.6.4 Examples

This section includes examples for creating custom templates. From time to time, Infinity Softworks posts supplemental materials on its web site. See product support at www.infinitysw.com/graph for additional examples.

6.6.4.1 Inflation

This example demonstrates template creation basics.

The Example

The equation for inflation is:

FutureVal = PresentVal * ((1+Inflation/100)^Years)

where

- FutureVal is the future amount.
- PresentVal is the present amount.

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- Inflation is the rate entered as a percentage (4 instead of .04).
- Years is the number of years between PresentVal and FutureVal.

The problem to calculate: if a pool costs $5,000, what is the expected cost 5 years from now if the inflation rate is 4%?

Creating the Template

1. Launch the software. The main calculator should be visible.

2. Select the Template button. The Template button is third from the left across the top of the main calculator. The Template List should be visible.

3. Select "New Template" near the bottom of the list.

4. Enter "Inflation" (no quotes) for the name.

5. Enter "FutureVal = PresentVal * ((1+Inflation/100)^Years)" (no quotes) for the equation.
   - equals (=) is on the right side of the keypad.
   - power (^) is available by selecting "f(x)" then math then "y^x".

6. Select "OK" to finish. The Inflation template should be visible.

Calculate Purchasing Power

7. Enter $5,000 for the present value.
   - select 0.00 next to PresentVal.
   - enter 5000 in the pop-up calculator using the keypad.
   - select the save ("✓") button.

8. Enter 4% inflation.
   - select 0 next to Inflation.
   - enter 4 in the pop-up calculator using the keypad.
   - select the save ("✓") button.

9. Enter 5 years.
   - select 0 next to Years.
   - enter 5 in the pop-up calculator using the keypad.
   - select the save ("✓") button.

10. Calculate the future value.
    - select the "?" button on the same line as FutureVal.
    - the cost after 5 years is $6,083.26.

For more on formatting variables, see the Templates : Using the Templates : Variable Preferences section. This template and others are available for free download from Infinity Softworks' web site: www.infinitysw.com/graph.

6.6.4.2 Constant Acceleration

This example demonstrates template creation basics.

The Example

The equation for constant acceleration is:

$$Velocity1^2 = Velocity0^2 + 2 * Accelrtn * Distance$$

where

- Velocity1 is the final velocity.
- Velocity0 is the initial velocity.
- Accelrtn is the speed of acceleration. Negative denotes deceleration.
- Distance is the distance between Velocity1 and Velocity0.

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The problem to calculate: what is the stopping distance for a car traveling 30 meters per second but decelerating 5 meters per second squared?

Creating the Template

1. Launch the software. The main calculator should be visible.

2. Select the Template button. The Template button is third from the left across the top of the main calculator. The Template List should be visible.

3. Select "New Template" near the bottom of the list.

4. Enter "Const Acclrtn" (no quotes) for the name.

5. Enter "Velocity1^2 = Velocity0^2 + 2 * Acclrtn * Distance" (no quotes) for the equation.
   - equals (=) is on the right side of the keypad.
   - power (^) is available by selecting f(x) then math then y^x.

6. Select "OK" to finish. The constant acceleration template should be visible.

Calculate Distance

7. Leave Velocity1 as 0.

8. Enter 30 m/s for Velocity0.
   - select 0 next to Velocity0.
   - enter 30 in the pop-up calculator using the keypad.
   - select the save ("✓") button.

9. Enter -5 m/s^2 for acceleration.
   - select 0 next to Acclrtn.
   - enter -5 in the pop-up calculator using the keypad.
   - select the save ("✓") button.

10. Calculate the distance.
    - select the "?" button on the same line as Distance.
    - the car will stop after 90 meters.

For more on formatting variables, see the Templates : Using the Templates : Variable Preferences section. This template and others are available for free download from Infinity Softworks' web site: www.infinitysw.com/graph.

6.6.4.3 Home Loan

This example demonstrates use of the financial functions. This template requires the Finance Library. The finance library is installed if the function list shows the category finance at the bottom. If it does not appear, reinstall the finance library.

The Example

The equation for calculating a mortgage is:

-Payment = tvmpmt(Years*12; IntRate; Mortgage; 0; 12; 12; 0)

where

- Payment is the monthly house payment.
- Years is the number of years to pay off the loan (multiply by 12 to get total number of periods).
- IntRate is the rate entered as a percentage (4 instead of .04).
- Mortgage is the loan amount.

(0; 12; 12; 0 are constants included in the function call. These are added to simplify data entry. The first 0 assumes the mortgage is paid down to 0. The first 12 assumes monthly payments. The second 12 assumes interest compounds monthly. The second 0 assumes payments are made at the end of the period, common for loans and mortgages.)

The problem to calculate: what is the monthly payment to pay off a $300,000 mortgage at 6.75% interest over 30 years?

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Creating the Template

1. Launch the software. The main calculator should be visible.

2. Select the Template button. The Template button is third from the left across the top of the main calculator. The Template List should be visible.

3. Select "New Template" near the bottom of the list.

4. Enter "Mortgage" (no quotes) for the name.

5. Enter "-Payment = tvmpmt(Years*12; IntRate; Mortgage; 0; 12; 12; 0)" (no quotes) for the equation.
   - negative and minus are the same. It is on the right side of the keypad.
   - equals (=) is on the right side of the keypad.
   - TVM payment (tvmpmt) is available by selecting f(x) then finance at the bottom of the list. If the category finance is not available, the finance library may not be installed. Reinstall the finance library to complete this problem.

6. Select "OK" to finish. The mortgage template should be visible.

Calculate Monthly Payment

7. Enter 30 years.
   - select 0 next to Years.
   - enter 30 in the pop-up calculator using the keypad.
   - select the save ("✓") button.

8. Enter 6.75% interest rate.
   - select 0 next to IntRate.
   - enter 6.75 in the pop-up calculator using the keypad.
   - select the save ("✓") button.

9. Enter a $300,000 mortgage.
   - select 0 next to Mortgage.
   - enter 300000 in the pop-up calculator using the keypad.
   - select the save ("✓") button.

10. Calculate the monthly payment.
    - select the "?" button on the same line as Payment.
    - the payment is $1,945.79 per month.

For more on formatting variables, see the Templates : Using the Templates : Variable Preferences section. This template and others are available for free download from Infinity Softworks' web site: www.infinitysw.com/graph.

6.6.4.4 "IF" Statements

If statements are used for conditional situations. If statements can be used by themselves or nested, meaning a second if statement is used within a first (the example below uses a nested if statement).

The Example

In this example, a profit sharing formula has three levels:

- If net income is less than or equal to $1 million, there is no profit sharing.
- If net income is greater than $1 million but less than or equal to $5 million, profit sharing is 2% of monthly pay.
- If net income is greater than $5 million, profit sharing is 4% of monthly pay.

With a monthly base of $3000, what is the profit sharing amount if the company's net income is $700,000, $2 million and $10 million?

The equation for calculating this profit sharing formula is:

NetPay = BasePay + if(NetIncome <= 1000000; 0; if(NetIncome > 1000000 && NetIncome <= 5000000; BasePay * .02; BasePay * .04))

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where

- NetPay is the final, monthly net pay including base pay and profit sharing.
- BasePay is the monthly base pay.
- NetIncome is the net income earned by the company.

The format for if statements is if(conditional true; do this; otherwise do this). To break down the equation:

- The first if statement says if net income is less than or equal to (<=) 1,000,000, add 0 otherwise do the second if statement.
- The second if statement says if net income is greater than (>) 1,000,000 and (&&) net income is less than or equal to (<=) $5,000,000, then add in 2% of the base pay. If it doesn't meet this condition, than net income must be larger since we took care of all other conditions. Add in 4% of base pay instead.
- Note that nested if statements read from left to right. If the first criteria is true, the solver will not continue to the false statement. Because of that, the formula could be written as: NetPay = BasePay + if(NetIncome <= 1000000; 0; if(NetIncome <= 5000000; BasePay * .02; BasePay * .04)) leaving out "NetIncome > 1000000 &&" in the second, nested if statement.

Creating the Template

1. Launch the software. The main calculator should be visible.

2. Select the Template button. The Template button is third from the left across the top of the main calculator. The Template List should be visible.

3. Select "New Template" near the bottom of the list.

4. Enter "Profit Sharing" (no quotes) for the name.

5. Enter "NetPay = BasePay + if(NetIncome <= 1000000; 0; if(NetIncome > 1000000 && NetIncome <= 5000000; BasePay * .02; BasePay * .04))" (no quotes) for the equation.
   - equals (=) is on the right side of the keypad.
   - parentheses ( ) are on the right side of the keypad next to multiply.
   - if, less then or equal to (<=), and greater than (>) are available by selecting "f(x)" then "bool".
   - Semi-colon (;) is on the left side of the keypad below "f(x)".

6. Select "OK" to finish. The profit sharing template should be visible.

Calculate NetPay (Net Income is $700,000)

7. Enter $3,000 for base pay.
   - select 0 next to BasePay.
   - enter 3000 in the pop-up calculator using the keypad.
   - select the save ("✓") button.

8. Enter $700,000 for net income.
   - select 0 next to NetPay.
   - enter 700000 in the pop-up calculator using the keypad.
   - select the save ("✓") button.

9. Calculate the monthly payment.
   - select the "?" button on the same line as NetPay.
   - the net pay is $3,000.

Calculate NetPay (Net Income is $2,000,000)

10. Enter $2,000,000 for net income.
   - select 700,000 next to NetPay.
   - enter 2000000 in the pop-up calculator using the keypad.
   - select the save ("✓") button.

11. Calculate the monthly payment.

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- select the "?" button on the same line as NetPay.
- the net pay is $3,060.

Calculate NetPay (Net Income is $10,000,000)

12. Enter $10,000,000 for net income.
    - select 2,000,000 next to NetPay.
    - enter 10000000 in the pop-up calculator using the keypad.
    - select the save ("✓") button.
13. Calculate the monthly payment.
    - select the "?" button on the same line as NetPay.
    - the net pay is $3,120.

For more on formatting variables, see the Templates : Using the Templates : Variable Preferences section. This template and others are available for free download from Infinity Softworks' web site: www.infinitysw.com/graph.

6.6.4.5 "Solving" Statements

Solving statements are used in connection with if statements to offer multi-equation calculation capabilities.

The Example

This example calculates both the final price of a product with sales tax and the sale tax itself. The equation for calculating the final price is:

FinalPrice = Cost * (1+TaxRate%)
or
0 = Cost * (1+TaxRate%) - FinalPrice

The equation for calculating the tax amount is:

TaxAmt = Cost * TaxRate%
or
0 = Cost * TaxRate% - TaxAmt

where

- Cost is the cost of the good or service.
- TaxRate is the tax rate expressed as a percentage (4 instead of .04).
- FinalPrice is the final price of the good or service with sales taxes.
- TaxAmt is the amount of the sales tax.

On a $29.99 purchase in a state with 7.25% sales tax, what is the final price of the product and how much is paid in sales tax?

In this case, the formula is:

0 = if(solving() == "Cost" || solving() == "FinalPrice"; Cost * (1 + TaxRate%) - FinalPrice;
Cost * TaxRate% - TaxAmt)

The format for if/solving statements is if(solving() == "variable"; do this; otherwise do this). To break down the equation:

- (solving() == "Cost" || solving() == "FinalPrice") says if the "?" button next to Cost or (||) FinalPrice is selected, perform the first calculation otherwise perform the second calculation.
- The parentheses next to solving are required, otherwise the solver thinks it is variable "solving".
- Notice the double equals sign (==), which is different than the single version (=). The single equals is assignment while the double equals is comparison.
- Because two equations are used in the calculation, it is not possible to put a variable on the left side of the equals sign. In this case "0 =" is used and the variables being calculated (FinalPrice and TaxAmt) are moved to the right side as a part of the equation. Leaving "0 =" out of the equation causes calculation problems.

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Creating the Template

1. Launch the software. The main calculator should be visible.

2. Select the Template button. The Template button is third from the left across the top of the main calculator. The Template List should be visible.

3. Select "New Template" near the bottom of the list.

4. Enter "Sales Tax" (no quotes) for the name.

5. Enter "0 = if(solving() == "Cost" || solving() == "FinalPrice"; Cost * (1 + TaxRate%) - FinalPrice; Cost * TaxRate% - TaxAmt)" (no quotes) for the equation.
   - equals (=) is on the right side of the keypad next to plus.
   - if, solving(), or (||) and comparison equals (==) are available by selecting "f(x)" then "bool".
   - Quotes (" ") are on the right side of the keypad next to equals.
   - Semi-colon (;) is on the left side of the keypad below "f(x)".
   - Percent (% or %x) is available by selecting "f(x)" then "math". This is the same as TaxRate/100.
   - parentheses ( ) are on the right side of the keypad next to multiply.

6. Select "OK" to finish. The sales tax template should be visible.

7. Turn off auto-solve in the template preferences.
   - select the menu button (below the Applications button) or, on some devices, select the title bar.
   - choose the Options menu.
   - select "Template Prefs".
   - uncheck Auto-Compute.
   - select "OK". The sales tax template should be visible.

Calculate Final Price with Sales Tax

8. Enter $29.99 for cost.
   - select 0 next to Cost.
   - enter 29.99 in the pop-up calculator using the keypad.
   - select the save ("✓") button.

9. Enter 7.25% for sales tax rate.
   - select 0 next to TaxRate.
   - enter 7.25 in the pop-up calculator using the keypad.
   - select the save ("✓") button.

10. Calculate the final price.
    - select the "?" button on the same line as FinalPrice.
    - the final price, including sales tax, is $32.16.

Calculate the Tax Amount

11. Calculate the sales tax amount.
    - select the "?" button on the same line as TaxAmt.
    - the net pay is $2.17.

For more on formatting variables, see the Templates : Using the Templates : Variable Preferences section. This template and others are available for free download from Infinity Softworks' web site: www.infinitysw.com/graph.

6.6.4.6 Multiple Answers

Some equations offer more than one answer to a problem. If statements and solving make the problem possible. Preferences also need to be adjusted to make sure calculations are performed in the appropriate range.

The Example

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This example calculates both the positive and negative values of x when y is equal to $x^2 - 3$.

In this case, the formula is:

0 = if(solving() == "PosX"; -y + PosX^2 - 3; -y + NegX^2 - 3)

See the "IF" Statement and "Solving" Statement examples for more on using these functions in solver equations.

Creating the Template

1. Launch the software. The main calculator should be visible.

2. Select the Template button. The Template button is third from the left across the top of the main calculator. The Template List should be visible.

3. Select "New Template" near the bottom of the list.

4. Enter "Quadratic" (no quotes) for the name.

5. Enter "0 = if(solving() == "PosX"; -y + PosX^2 - 3; -y + NegX^2 - 3)" (no quotes) for the equation.
   - equals (=) is on the right side of the keypad next to plus.
   - if, solving(), and comparison equals (==) are available by selecting "f(x)" then "bool".
   - Quotes (" ") are on the right side of the keypad next to equals.
   - Semi-colon (;) is on the left side of the keypad below "f(x)".

6. Select "OK" to finish. The quadratic template should be visible.

7. Turn off auto-solve in the template preferences.
   - select the menu button (below the Applications button) or, on some devices, select the title bar.
   - choose the Options menu.
   - select "Template Prefs".
   - uncheck Auto-Compute.
   - select "OK". The sales tax template should be visible.

8. Adjust the range for PosX and NegX. The solver usually finds positive results first. Adjust the range to force the negative answer.
   - select the menu button (below the Applications button) or, on some devices, select the title bar.
   - choose the Options menu.
   - select "Variable Prefs".
   - select "y" next to Variable.
   - choose "PosX".
   - change Range : Min to 0 by selecting the arrow to the right of min and selecting "0".
   - select "PosX" next to Variable.
   - choose "NegX".
   - change Range : Max to 0 by selecting the arrow to the right of max and selecting "0".

Calculate the Positive X Value

9. Enter 9 for y.
   - select 0 next to y.
   - enter 9 in the pop-up calculator using the keypad.
   - select the save ("✓") button.

10. Calculate the positive x value.
   - select the "?" button on the same line as PosX.
   - the positive x value is 3.46.

Calculate the Negative X Value

10. Calculate the negative x value.
   - select the "?" button on the same line as NegX.
   - the negative x value is -3.46.

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For more on formatting variables, see the Templates : Using the Templates : Variable Preferences section. This template and others are available for free download from Infinity Softworks' web site: www.infinitysw.com/graph.

6.6.4.7 Using Data in Multiple Templates

The global preference setting for variables makes it possible to share data between templates.

The Example

This example will utilize the inflation template created earlier.

The problem: summarize average monthly expenses and determine the equivalent amount needed 30 years from now to retire. The monthly expenses to consider:

- Rents including gas, electricity, water and garbage
- Health Insurance
- Groceries
- Automobile Expenses
- Entertainment

To perform the calculation, one template will be created to summarize these expenses. This template will share the total amount with a second, inflation calculation template.

Create the Inflation Template

If the inflation template has already been created, skip to step 7.

1. Launch the software. The main calculator should be visible.

2. Select the Template button. The Template button is third from the left across the top of the main calculator. The Template List should be visible.

3. Select "New Template" near the bottom of the list.

4. Enter "Inflation" (no quotes) for the name.

5. Enter "FutureVal = PresentVal * ((1+Inflation/100)^Years)" (no quotes) for the equation.
   - equals (=) is on the right side of the keypad.
   - power (^) is available by selecting f(x) then math then y^x.

6. Select "OK" to finish. The Inflation template should be visible.

7. Make PresentVal a global variable so its data can be shared.
   - select the menu button (below the Applications button) or, on some devices, select the title bar.
   - choose the Options menu.
   - select "Variable Prefs".
   - select "FutureVal" next to Variable.
   - choose "PresentVal".
   - check the box next to Global.
   - select "OK". The inflation template should be visible.

Creating the Expense Summary Template

8. From the Inflation template, select Done.

9. Select the Template button. The Template button is third from the left across the top of the main calculator. The Template List should be visible.

10. Select "New Template" near the bottom of the list.

11. Enter "EXP Summary" (no quotes) for the name.

12. Enter "Rents + Insurance + Groceries + Auto + ENT = PresentVal" (no quotes) for the equation.
   - equals (=) is on the right side of the keypad.

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13. Select "OK" to finish. The Expense Summary template should be visible.

14. Make FutureVal a global variable so its data can be shared.
- select the menu button (below the Applications button) or, on some devices, select the title bar.
- choose the Options menu.
- select "Variable Prefs".
- select "Rents" next to Variable.
- choose "PresentVal".
- check the box next to Global.
- select "OK". The inflation template should be visible.

Calculate Present Value

15. Enter $750 for the total rents.
- select 0.00 next to Rents.
- enter 750 in the pop-up calculator using the keypad.
- select the save ("✓") button.

16. Enter $400 for medical insurance.
- select 0 next to Insurance.
- enter 400 in the pop-up calculator using the keypad.
- select the save ("✓") button.

17. Enter $200 for groceries.
- select 0 next to Groceries.
- enter 200 in the pop-up calculator using the keypad.
- select the save ("✓") button.

18. Enter $150 for automobile expenses.
- select 0 next to Groceries.
- enter 150 in the pop-up calculator using the keypad.
- select the save ("✓") button.

19. Enter $200 for entertainment.
- select 0 next to ENT.
- enter 200 in the pop-up calculator using the keypad.
- select the save ("✓") button.

20. Calculate the total monthly expenses.
- select the "?" button on the same line as PresentVal.
- the total monthly expenses are $1,700.

Calculate the Future Cash Requirement to Retire

21. Select "Done" at the bottom of the Inflation template. The main calculator should be visible.

22. Select the Template button. The Template button is third from the left across the top of the main calculator. The Template List should be visible.

23. Select the "Unfiled" category.

24. Select the Inflation template. The Inflation template should be visible with $1,700 as the PresentVal.

25. Enter 4% for inflation.
- select 0.00 next to Inflation.
- enter 4 in the pop-up calculator using the keypad.
- select the save ("✓") button.

26. Enter 30 years.
- select 0.00 next to Years.
- enter 30 in the pop-up calculator using the keypad.

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- select the save ("✓") button.

27. Calculate the future cash requirements for the same monthly expenses.
    - select the "?" button on the same line as FutureVal.
    - the total monthly expenses are $5,513.78.

For more on formatting variables, see the Templates : Using the Templates : Variable Preferences section. This template and others are available for free download from Infinity Softworks' web site: www.infinitysw.com/graph.

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7 Appendix

7.1 Calculator Error Messages

Algebraic and RPN Input Modes

The following error messages may appear in algebraic and RPN input modes. Common causes are also listed.

- **-Infinity:** a value is calculated that is smaller than -1e308.
- **+Infinity:** a value is calculated that is greater than 1e308.
- **Can't bracket solution:** returned when solving and the solver cannot find an answer
- **Division by 0:** a value is divided by zero
- **Empty data set:** the function requires a data set (matrix/vector or table/list) but none was provided
- **Invalid array dimensions:** a problem with the table or matrix dimensions when working with certain math functions (e.g., determinant when dimensions are not square or data and frequency lists with different lengths)
- **Invalid data type:** a function cannot use a passed data type (e.g., using a complex number for greatest common divisor)
- **Iteration limit exceeded:** the solver has a cap on how long it will try to find an answer. This error is returned if that limit is exceeded
- **Matrix is singular:** special matrix case that cannot be calculated [e.g., det([[1;2;3];[2;4;6];[3;2;1]])]
- **Memory access error:** general memory problem or the device ran out of memory
- **Missing ":** quotation marks are required but missing
- **Missing left delimiter:** missing (, { , [
- **Missing or invalid operand:** equation not completed or not enough items on the stack
- **Missing right delimiter:** missing) , } ,]
- **Not a number:** no valid response can be determined
- **Not enough arguments:** function call missing all or some of its arguments (e.g., sin() without sending a value)
- **Operand out of range:** a value is entered that is outside the value limits of +/- 1e308
- **Too many arguments:** function call with too many arguments (e.g., sin(2;3) when sin requires one argument)
- **Too many nested operations:** more that 64 nested parentheses ( ), brackets [ ] or braces { }
- **Unexpected list separator:** parentheses, braces, or brackets may be missing from a list
- **Unknown function:** calling a function that does not exist
- **Unknown variable:** using a variable that does not exist
- **Variable is constant:** the variable is altered but since it is set as a constant, it cannot be changed

Order of Operations and Chain Input Modes

In order of operations and chain input modes, "error" may appear in the view window. The cause may be one of the following:

- Overflow or underflow occurs in the calculation.
- Divide by 0.
- Reciprocal when x = 0.
- Square root when x < 0.
- Factorial when x < -169, x > 169.
- Natural log when x <= 0.
- Permutations when n < 0, r < 0, or r or n is not an integer.
- Combinations when n < 0, r < 0, or r or n is not an integer.
- Used too many levels of parentheses.
- Entered a number outside the range of 1e-308 to 1e308 and
- -1e–308 to –1e308.

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7.2 Restricted Data Names

When creating data types, it is recommended that they do not have the following names because they may by overwritten during software use:

arc	l	t
b	m	tolerance
e	n	u
deriv	pi	v
dist	r	w
i	r2	x
integral	R2	y

7.3 Technical Support

For technical support, please visit Infinity Softworks' web site:

www.infinitysw.com/graph

The web site contains:

- Extensive database of technical support questions and answers
- Contact telephone numbers, mail and email addresses
- Free add-ons including templates, skins, graphs, data sets and import/export/beam plug-ins
- Training and curriculum materials

7.4 Printing This Manual

While Infinity Softworks does not offer a printed version of this manual, you are welcome to print it yourself.

To print, you will need Adobe Acrobat Reader (.pdf). If this is the Adobe Acrobat Reader version of the manual, select the menu "File" then "Print". The manual is very long. It may be wise to print the sections needed instead of the entire manual or, if your printer supports it, printing multiple pages per sheet.

To download a copt of Adobe Acrobat Reader, visit Adobe's web site:

http://www.adobe.com/reader

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